THE INSECTS AND ARACHNIDS OF CANADA

PART 3

The Aradidae of Canada

Hemiptera: Aradidae

Agriculture Canada

THE INSECTS AND ARACHNIDS OF CANADA

PART 3

The Aradidae of Canada

Hemiptera: Aradidae

Ryuichi Matsuda

Biosystematics Research Institute
Ottawa, Ontario

Research Branch
Canada Department of Agriculture

Publication 1634 1977

© Minister of Supply and Services Canada 1977

Available by mail from

Printing and Publishing
Supply and Services Canada
Ottawa, Canada K1A 0S9

or through your bookseller.

Catalogue No. A42-42 1977-3 **Canada: $4.00**
ISBN 0-660-01428-9 **Other countries: $4.80**

Price subject to change without notice.

The Insects and Arachnids of Canada. Part 1. Collecting, Preparing, and Preserving Insects, Mites, and Spiders compiled by J. E. H. Martin, Canada Department of Agriculture, Ottawa, is in preparation.

The Insects and Arachnids of Canada. Part 2. The Bark Beetles of Canada and Alaska (Coleoptera: Scolytidae) by D. E. Bright, Jr., Canada Department of Agriculture, Ottawa, was published in 1976.

Contents

Introduction 7
Acknowledgments 7
Structures and terminologies 9
Method 10
Key to subfamilies and genera of Aradidae in Canada 10
Key to subgenera and species of *Aradus* (Fabricius 1803) in Canada and adjacent states of the USA 11
Descriptions of species of *Aradus* (Fabricius 1803) 16
Aradus (Quilnus) heidemanni Bergroth 16
Aradus (Quilnus) niger Stål 18
Aradus (Quilnus) nigrinus canadensis Parshley 19
Aradus (Aradus) cinnamomeus Panzer 21
Aradus (Aradus) insolitus Van Duzee 22
Aradus (Aradus) aequalis Say 23
Aradus (Aradus) quadrilineatus Say 25
Aradus (Aradus) gracilis Parshley 26
Aradus (Aradus) crenatus Say 27
Aradus (Aradus) uniformis Heidemann 28
Aradus (Aradus) martini Matsuda 29
Aradus (Aradus) depictus Van Duzee 30
Aradus (Aradus) parvicornis Parshley 31
Aradus (Aradus) montanus Bergroth 32
Aradus (Aradus) intectus Parshley 32
Aradus (Aradus) saileri Kormilev 33
Aradus (Aradus) duzeei Bergroth 34
Aradus (Aradus) implanus Parshley 35
Aradus (Aradus) behrensi Bergroth 37
Aradus (Aradus) fuscomaculatus Stål 38
Aradus (Aradus) robustus Uhler 40
Aradus (Aradus) approximatus Parshley 41
Aradus (Aradus) inornatus Uhler 43
Aradus (Aradus) acutus Say 44
Aradus (Aradus) paganicus Parshley 45
Aradus (Aradus) blaisdelli Van Duzee 46
Aradus (Aradus) opertaneus Parshley 47
Aradus (Aradus) lawrencei Kormilev 48
Aradus (Aradus) compressus Heidemann 49
Aradus (Aradus) borealis Heidemann 51
Aradus (Aradus) uniannulatus Parshley 52
Aradus (Aradus) abbas Bergroth 55
Aradus (Aradus) lugubris Fallén 57
Aradus (Aradus) tuberculifer Kirby 59
Aradus (Aradus) parshleyi Van Duzee 60
Aradus (Aradus) funestus Bergroth 60
Aradus (Aradus) fallèni Stål 62
Aradus (Aradus) debilis Uhler 63
Aradus (Aradus) similis Say 64
Aradus (Aradus) persimilis Van Duzee 65
Aradus (Aradus) shermani Heidemann 66

Aradus (Aradus) vadosus Van Duzee 68
Aradus (Aradus) consors Parshley 69
Aradus (Aradus) medioximus Parshley 70
Aradus (Aradus) proboscideus Walker 73
Aradus (Aradus) basalis Parshley 74
Aradus (Aradus) serratus Usinger 75
Key to the species of *Aneurus* Curtis (1825) in Canada 75
Descriptions of species of *Aneurus* Curtis (1825) 77
Aneurus septentrionalis Walker 77
Aneurus inconstans Uhler 78
Figures 1–15 80
Plates 1–15 96
Glossary 111
References 114

Introduction

The aradid bugs are known as flat bugs. Their thin body and sombre color are remarkable adaptations for their life under barks; this is especially true of the species of *Aneurus*, which are certainly among the thinnest of all insects. They are, with the exception of *Aradus cinnamomeus* (p. 21), mycetophagous and their coiled stylets are remarkably suited for sucking the juices of fungi that occur on various coniferous and deciduous trees.

This work is intended to facilitate the identification of the aradid bugs that are known to occur in Canada and adjacent states of the USA. The two genera treated are *Aradus*, with 47 species, and *Aneurus*, with 2 species. The associated (host) plants for 27 species, which represent nearly 60% of the species treated, are also given in the text.

Acknowledgments

I am deeply grateful to the following persons and institutions for sending me valuable specimens on loan: Dr. P. H. Arnaud, California Academy of Sciences, San Francisco, Calif.; Dr. R. C. Froeschner, U.S. National Museum, Washington, D.C.; Prof. L. L. Pechuman, Department of Entomology, Cornell University, Ithaca, N.Y.; Prof. G. E. Scudder, Department of Zoology, University of British Columbia, Vancouver, B.C.; Prof. V. R. L. Vickery, Department of Entomology, Macdonald College, McGill University, St. Anne de Bellevue, Que.; Profs. D. R. Whitehead and G. E. Ball, Department of Entomology, University of Alberta, Edmonton, Alta.; and Dr. P. Wygodzinsky, American Museum of Natural History, New York, N.Y.

Structures and terminologies

HEAD: The head of Aradidae is of the opisthognathous type, in which the mouthparts lie posterior ventral because of a deflection of the facial portion, and is highly specialized to accommodate the sucking mouthparts suited for feeding on fungi. In *Aradus* (Fig. 1*A–D*) the clypeus, or tylus, is strongly developed to accommodate two sets of stylets (the maxillary and mandibular stylets) that are coiled up within. The clypeus is called the median process in the text. The 4-segmented antenna is borne by a prominent tubercle called the antenniferous tubercle. A less-developed tubercle in front of each compound eye is called the preocular tubercle. The 4-segmented labium, or beak (Fig. 1*B*), is called the rostrum; it ensheathes the mandibular and maxillary stylets.

THORAX: In *Aradus* the pronotum, or the dorsal part of the 1st (anterior) thoracic segment, covers posteriorly the anterior portion of the mesothorax (2nd thoracic segment), and the surface of the pronotum is provided with three pairs of longitudinal carinae (ridges), which are called median, paramedian, and lateral carinae (*see* Figs. 2–15). The lateral carinae are often obsolete and indistinct.

The wings consist of paired fore wings called the hemelytra and membranous hind wings. The wings in Aradidae are exceedingly diverse in degree of development. Many genera in the tropics are wingless (apterous). The females of some species of *Aradus* have short wings (brachypterous, Pl. 5*C*) or vestigial wings (micropterous, Pl. 1*B*, *E*). In the males of some species of *Aradus*, narrowing of wings, or stenoptery, occurs (Pl. 1*C*). The fore wing venation in *Aradus* is as shown in Fig. 1*E*. In *Aneurus* the wings are always fully developed (macropterous) and hyaline, but the basal leathery part of each hemelytron, called the corium, is greatly reduced. The scutellum, which represents a dorsal shield of the mesonotum, is always exposed between hemelytra, in both *Aradus* and *Aneurus*.

ABDOMEN: In *Aradus* the 1st abdominal segment is ventrally absent; the dorsal plate, or tergite, of the 1st abdominal segment is completely fused with the 2nd abdominal tergite. Each side of each tergite of the abdominal segments is separated by a longitudinal suture (Fig. 2), and the laterally separated piece of the tergite is called the connexivum. In the female of *Aradus* the 7th segment is split on the ventral median longitudinal axis. The plates bearing the 1st pair of valvulae (lobes) of the ovipositor (egg-laying apparatus), called the valvifers, are usually exposed behind the two-lobed 7th sternite (ventral plate). The 8th tergite (Fig. 2) may be hidden by or exposed behind the hemelytra (fore wings). The paired posterolateral lobes of the 8th tergite correspond to the connexiva in preceding segments. In the female of *Aradus* the connexival lobes are taxonomically useful; they are shown in Figs. 2–15. In the male of *Aradus* the 9th segment forms the genital capsule or pygophore; it is enclosed within the cavity formed by depression of the 8th segment and is hidden from above by the wing.

In the female of *Aneurus* no median longitudinal split of the 7th sternite occurs, and the three lobes (Pl. 15*B*, *D*, *F*, *H*) represent the 9th segment. In the male (Pl. 15*A*, *C*, *E*, *G*) three apical lobes represent the 8th segment (lateral pair of lobes) and the 9th segment (median lobe, *see* Pl. 15*C–H*); the latter is the genital capsule.

In *Aradus* the positions of abdominal segmental spiracles (openings of the internal respiratory system) are on the ventral side of the connexiva; in *Aneurus* they are sometimes on the lateral edges of the latter and their positions are of taxonomic importance. For more information about the morphology of Aradidae, see Usinger and Matsuda (1959) and Kumar (1967). A glossary of technical terms used in the description of species is given on p. 111.

Method

All the species of Aradidae known to occur in Canada are included in this publication. For each species, the following information is given: synonyms (if any), a brief diagnosis, distribution, and associated plants. Almost all species are illustrated by habitus photographs and line drawings of antennae, pronota, and posterior abdominal segments. A distribution map is given for most species.

The references given at the end of this publication are not intended to be complete. Several references, such as Parshley (1921), Usinger (1936), and Usinger and Matsuda (1959), contain information on most of the species treated herein, and Strickland (1953) lists the species of *Aradus* that occur in Alberta.

Key to subfamilies and genera of Aradidae in Canada

The two genera of aradids, *Aradus* and *Aneurus*, belong to two different subfamilies and they are readily distinguished with the aid of the following key.

Body flat but not paper thin. Hemelytra with distinct veins. Rostrum usually extending beyond posterior margin of head. Male genital capsule dorsal ..... ***Aradus* Fabricius 1803 (Aradinae Amyot & Serville 1843)**

Body nearly paper thin. Hemelytra hyaline and without veins. Rostrum never extending beyond posterior margin of head. Male genital capsule terminal ..... ***Aneurus* Curtis 1825 (Aneurinae Douglas & Scott 1865)**

Key to subgenera and species of *Aradus* (Fabricius 1803) in Canada and adjacent states of the USA

1. Rostrum not extending beyond base of head. Pronotum trapezoidal, not explanate laterally (subgenus *Quilnus* Stål 1873) 2

   Rostrum extending beyond base of head. Pronotum more or less explanate laterally (subgenus *Aradus* Fabricius 1803) 4

2. 2nd antennal segment thinner than front femora (Pl. 1*A*, Fig. 2). Length of body more than 7.5 mm ..... ***A. (Q.) heidemanni*** **Bergroth** (p. 16)

   2nd antennal segment as thick as or thicker than front femora. Length of body less than 6.5 mm 3

3. 2nd antennal segment thicker than front femora, and lateral margins of scutellum carinated only anteriorly in macropterous form (Pls. 1*F*, 2*A*, Fig. 2) ..... ***A. (Q.) niger*** **Stål** (p. 18)

   2nd antennal segment as thick as front femora, and lateral margins of scutellum well carinated throughout in macropterous form (Pl. 2*B*, Fig. 3) ..... ***A. (Q.) nigrinus canadensis*** **Parshley** (p. 19)

4. Median carinae of pronotum obliterated anteriorly (Pl. 1*C–E*, Fig. 2) ..... ***A. (A.) cinnamomeus*** **Panzer** (p. 21)

   Median carinae reaching anterior margin of pronotum 5

5. Pronotum widest before middle (*A. gracilis* in Fig. 3, *A. crenatus* in Fig. 4) 6

   Pronotum widest at or behind middle 7

6. 2nd antennal segment more than twice as long as 3rd antennal segment (Pl. 9*D*, Fig. 3) ..... ***A. (A.) gracilis*** **Parshley** (p. 26)

   2nd antennal segment only slightly longer than 3rd antennal segment (Pl. 3*D*, *E*, Fig. 4) ..... ***A. (A.) crenatus*** **Say** (p. 27)

7. Lateral margin of pronotum distinctly sinuate in anterior half, and distinctly angularly produced behind middle (Pl. 2*C*, *D*, Fig. 3). Rostrum reaching middle of prosternum ..... ***A. (A.) insolitus*** **Van Duzee** (p. 22)

   Lateral margin of pronotum may be sinuate in anterior half, but not angularly produced behind middle. Rostrum usually extending beyond middle of prosternum 8

8. 2nd antennal segment as long as or slightly longer than 3rd (Pl. 3*E*, *F*, Fig. 3) ..... ***A. (A.) aequalis*** **Say** (p. 23)

   2nd antennal segment distinctly longer than 3rd 9

9. 3rd antennal segment 1.5 times as thick as 2nd (Fig. 4). 2nd segment yellow in apical half (Pl. 3*B*, *C*) ..... ***A. (A.) quadrilineatus*** **Say** (p. 25)

   3rd antennal segment as thick as or only slightly thicker than 2nd. Color of 2nd segment otherwise 10

10. 3rd antennal segment totally or nearly totally yellow 11
    3rd antennal segment not yellow 16

11. 3rd antennal segment about one-third as long as 2nd segment (Pl. 12*C*, *D*, Fig. 13) ..... ***A. (A.) debilis*** **Uhler** (p. 63)

3rd antennal segment about half as long as 2nd segment 12

12. Lateral margin of pronotum distinctly denticulated (Pls. 4*A*, *B*, 12*E*, *F*) 13

Lateral margin of pronotum without distinct denticulation (Pls. 3*A*, *F*, 12*A*, *B*) 14

13. Body highly variegated in coloration (Pl. 4*A*, *B*, Fig. 5) ..... ***A. (A.) depictus*** **Van Duzee** (p. 30)

Body predominantly dark brown (Pl. 12*E*, *F*, Fig. 13) ..... ***A. (A.) similis*** **Say** (p. 64)

14. 2nd antennal segment pale yellow except base. Body slender (Pl. 12*A*, *B*, Fig. 12) ..... ***A. (A.) fallèni*** **Stål** (p. 62)

2nd antennal segment black. Body robust, not slender (Pl. 3*A*, *F*) 15

15. Anterior half of pronotal lateral margin almost straight (Pl. 3*A*, Fig. 4) ..... ***A. (A.) uniformis*** **Heidemann** (p. 28)

Anterior half of pronotal lateral margin rounded (Pl. 3*F*, Fig. 5) ..... ***A. (A.) martini*** **Matsuda** (p. 29)

16. Median process of head robust and extending slightly beyond 2nd antennal segment (Pl. 4*D*, Fig. 5) ..... ***A. (A.) parvicornis*** **Parshley** (p. 31)

Median process of head not robust and its apex not reaching middle of 2nd antennal segment 17

17. 2nd antennal segment definitely less than twice as long as 3rd segment 18

2nd antennal segment almost twice or clearly more than twice as long as 3rd segment 24

18. Anterior end of lateral margin of pronotum with robust and angular projection (Pl. 4*E*, *F*, Fig. 6) ..... ***A. (A.) montanus*** **Bergroth** (p. 32)

Anterior end of lateral margin of pronotum without robust and angular projection 19

19. Posterior end of scutellum yellow (Pls. 5*D–F*, 6*A–E*) 20
Scutellum unicolorous (Pls. 5*A–C*, 6*F*, 7*A*, *B*) 23

20. Lateral margin of pronotum without denticulation. Female 8th connexival lobes large and broadly rounded apically (*A. duzeei* in Fig. 6 and *A. implanus* in Fig. 7) 21

Lateral margin of pronotum denticulated in anterior half. Female 8th connexival lobes transverse (*A. fuscomaculatus* and *A. behrensi* in Fig. 7) 22

21. Pronotum widest behind middle (Fig. 6) and unicolorous (Pl. 5*D*, *E*) .... ***A. (A.) duzeei*** **Bergroth** (p. 34)

Pronotum widest at middle (Fig. 7) and with a pair of white spots along anterolateral margins (Pl. 6*A*) ..... ***A. (A.) implanus*** **Parshley** (p. 35)

22. Lateral margins of the scutellum distinctly elevated throughout (Pl. 6*D*, *E*) ..... ***A. (A.) fuscomaculatus*** **Stål** (p. 38)

Lateral margins of scutellum distinctly elevated only in anterior half (Pl. 6*B*, *C*) ..... ***A. (A.) behrensi*** **Bergroth** (p. 37)

23. Pronotum widest at middle (Fig. 8). Connexival segments crenulate (Pls. 6*F*, 7*A*) ..... ***A. (A.) robustus*** **Uhler** (p. 40)

Pronotum widest behind middle (Fig. 6). Connexival segment not crenulate (Pls. 5*A*–*C*, 7*B*) ..... ***A. (A.) intectus*** **Parshley** (p. 32)
A. (A.) saileri **Kormilev** (p. 33)

24. 2nd antennal segment about 3 times as long as 3rd. Antennae not thin 25

2nd antennal segment less than 2.5 times as long as 3rd. Antennae usually slender 29

25. Apical one-quarter of 2nd antennal segment suddenly swollen and black (Pl. 7*C*, *D*, Fig. 8) ..... ***A. (A.) approximatus*** **Parshley** (p. 41)

2nd antennal segment gradually swollen apically 26

26. Abdominal tergites inside connexivum with distinct silvery spots (Pl. 8*A*, *B*) ..... ***A. (A.) acutus*** **Say** (p. 44)

Abdominal tergites inside connexivum without distinct silvery spots 27

27. Median carinae of pronotum bulged behind middle (Pl. 8*C*, *D*, Fig. 9) ..... ***A. (A.) paganicus*** **Parshley** (p. 45)

Median carinae of pronotum not bulged behind middle 28

28. Pronotal surface nearly flat. Lateral margin of pronotum broadly rounded at middle. Eastern half of Canada in distribution (Pl. 7*E*, *F*, Fig. 9) ..... ***A. (A.) inornatus*** **Uhler** (p. 43)

Pronotal surface uneven. Lateral margin of pronotum not broadly rounded at middle. Western half of Canada in distribution (Pl. 8*E*, *F*, Fig. 10) ..... ***A. (A.) blaisdelli*** **Van Duzee** (p. 46)

29. Rostrum extending as far as middle of prosternum. 2nd antennal segment twice as long as 3rd (Pl. 9*A*, *B*, Fig. 10) .....
..... ***A. (A.) opertaneus*** **Parshley** (p. 47)
..... ***A. (A.) lawrencei*** **Kormilev** (p. 48)

Rostrum extending onto mesosternum. 2nd antennal segment usually more than twice as long as 3rd 30

30. Lateral margins of scutellum parallel-sided in anterior two-thirds, then strongly convergent posteriorly (Pl. 11*E*, *F*). Median carinae of pronotum strongly bulged in posterior half (Fig. 12) .....
..... ***A. (A.) funestus*** **Bergroth** (p. 60)

Lateral margins of scutellum may be parallel-sided only in anterior one-third to one-half. Median carinae not strongly bulged posteriorly 31

31. Apex of median process of head as thick as apex of 2nd antennal segment (Pl. 9*C*, *E*, *F*) 32

Apex of median process of head thicker than apex of 2nd antennal segment 33

32. Anterolateral margin of pronotum nearly straight or feebly rounded (Pl. 9*E*, *F*, Fig. 11) ..... ***A. (A.) borealis*** **Heidemann** (p. 51)

Anterolateral margin of pronotum sinuate (Pl. 9*C*, Fig. 10) ..... ***A. (A.) compressus*** **Heidemann** (p. 49)

33. Basal half of 2nd antennal segment yellow to yellowish brown (Pl. 11*A–D*) 34
Basal half of 2nd antennal segment not yellow 35

34. Color black, except pale posterior margins of connexival segments. Sides of scutellum sharply elevated (Pl. 11*C*, *D*, Fig. 12)..... ***A. (A.) tuberculifer*** **Kirby** (p. 59)

Color brown, except yellow markings on corium. Sides of scutellum not sharply elevated (Pl. 11*A*, *B*, Fig. 12) .. ***A. (A.) parshleyi*** **Van Duzee** (p. 60)

35. Anterior half of pronotal lateral margin sinuate and without conspicuous spines, though minutely denticulated (Fig. 11, except *A. borealis*) 36

Anterior half of pronotal lateral margin at least not distinctly sinuate and usually distinctly denticulated (Figs. 13–15) 38

36. Antennae rather thick (Pl. 10*E*, *F*, Fig. 11) .... ***A. (A.) lugubris*** **Fallén** (p. 57)
Antennae slender (Pl. 10*A–D*) 37

37. Midlength of pronotum as long as head (Pl. 10*C*, *D*, Fig. 11) ..... ***A. (A.) abbas*** **Bergroth** (p. 55)

Midlength of pronotum a little shorter than head (Pl. 10*A*, *B*, Fig. 11) ... ***A. (A.) uniannulatus*** **Parshley** (p. 52)

38. Median transverse impression of pronotum well marked. Anterior half of pronotum strongly elevated and anterolateral area of pronotum not reflected (Pl. 13*A*, *B*, Fig. 13) .... ***A. (A.) persimilis*** **Van Duzee** (p. 65)

Median transverse impression of pronotum may be well marked, but anterolateral area of pronotum clearly reflected 39

39. Whole body black except posterolateral angles of connexival segments and wings (Pl. 13*C*, *D*, Fig. 14) ..... ***A. (A.) shermani*** **Heidemann** (p. 66)

Body color otherwise 40

40. Dorsal surface of body pale yellow, variegated with black (Pl. 13*E*, *F*). 2nd antennal segment 2.5 times as long as 3rd (Fig. 14) ..... ***A. (A.) vadosus*** **Van Duzee** (p. 68)

Ground color of body surface otherwise. 2nd antennal segment less than 2.5 times as long as 3rd 41

41. Connexival segments distinctly crenulate. Female 8th connexival lobes almost as long as wide (Pl. 14*A*, Fig. 14) .. ***A. (A.) consors*** **Parshley** (p. 69)

Connexival segments not crenulate, or only feebly crenulate. Female 8th connexival lobes distinctly wider than long 42

42. Vertex of head with two rows of coarse granules (Pl. 14*B*, Fig. 15) .... ***A. (A.) medioximus*** **Parshley** (p. 70)

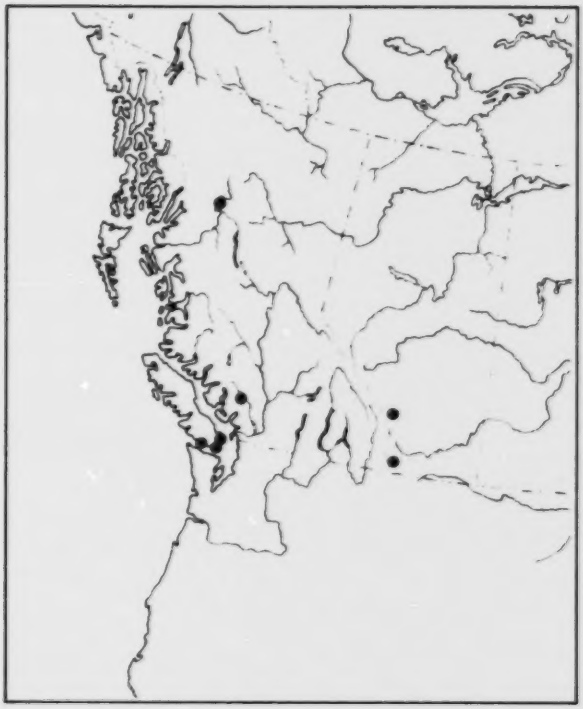
Vertex of head without a distinct row of coarse granules 43

43. Pronotum widest behind middle (Pl. 14*C*, *D*, Fig. 15) ..... ***A. (A.) proboscideus*** **Walker** (p. 73)

Pronotum widest at middle 44

44. Lateral margin of pronotum with evenly spaced distinct denticles (Pl. 14*F*, Fig. 15) ..... ***A. (A.) serratus*** **Usinger** (p. 75)

Lateral margin of pronotum with obscurely defined denticles (Pl. 14*E*, Fig. 15) ..... ***A. (A.) basalis*** **Parshley** (p. 74)



Map 1. Distribution of *Aradus heidemanni* Bergroth in Canada.

Descriptions of species of *Aradus* (Fabricius 1803)

Aradus (Quilnus) heidemanni Bergroth

(Pl. 1*A*, *B*, Fig. 2)

Aradus heidemanni Bergroth, 1906, p. 200.
Aradus (*Quilnus*) *heidemanni*: Parshley, 1921, p. 102.

Color: Unicolorous, dull dark brown to grayish black. Posterolateral angles of connexival segments may be paler.

Structure: Head with median process rather narrow, extending slightly beyond base of 2nd antennal segment. Relative lengths of antennal segments: 3.3:8.5:9.0:6.0; 2nd antennal segment thinner than front femora. Postocular lateral margins obtuse. Rostrum not extending beyond base of head.

Pronotum with lateral margin having fine tubercles, nearly straightly convergent anteriorly in stenopterous male and micropterous female, and broadly rounded posteriorly in macropterous female. In macropterous female,

median longitudinal carinae straight and convergent; paramedian carinae also straight and convergent, reaching basal two-thirds of pronotum; lateral carinae almost completely obliterated. In micropterous female and stenopterous male, the carinae are more obliterated, only median carinae being clearly recognizable.

Scutellum concave on upper surface; lateral margins rounded, ending in acute tip.

Hemelytra extending beyond posterior margin of 7th tergite in macropterous form, barely covering genitalia in stenopterous male, and extending slightly beyond level of apex of scutellum in micropterous form.

Abdomen broader than hemelytra at base in macropterous form (34:31 in male, 38:34 in female). Female 8th abdominal tergite and connexival lobes as shown in Fig. 2.

Length of body: 7.6–8.1 mm in male, and 7.8–8.3 mm in female.

Distribution (Map 1): British Columbia, Alberta, Washington, Oregon, California, New Mexico, and Colorado.

Associated plants: Reddish fungus on *Abies magnifica* and *Pinus lambertiana*.

Remarks: Wings are polymorphic, as stated in the description. This species is separable from the other species of the subgenus *Quilnus*, *A.* (*Q.*) *niger* and *A.* (*Q.*) *nigrinus canadensis*, by its distinctly larger body and by the 2nd antennal segment, which is thinner than the front femur.

Map 2. Distribution of *Aradus niger* Stål in Canada.

Aradus (Quilnus) niger Stål

(Pls. 1*F*, 2*A*, Fig. 2)

Aradus niger Stål, 1873, p. 137.
Aradus niger: Heidemann, 1901, p. 389.

Color: Unicolorous black. Posterolateral angles of connexival segments dirty yellow in some individuals.

Structure: Median process of head reaching base of 2nd antennal segment. 2nd antennal segment thicker than front femora. Relative lengths of antennal segments: 2.3:5.8:6.0:4.5. Postocular tubercles absent. Rostrum reaching posterior end of head.

Pronotum in macropterous form straight on lateral margin and with broadly rounded posterolateral angle, sinuate on posterior margin. Upper surface of pronotum with carinae almost completely obliterated; in some specimens obscurely defined median carinae are slightly convergent anteriorly. In micropterous form, carinae even less distinct.

Scutellum in macropterous form gently rounded on lateral margins, which are well carinated anteriorly, and its surface without conspicuous elevation.

Hemelytra often micropterous, their apices reaching or extending slightly beyond posterior end of scutellum; in macropterous form their apices reaching posterior margin of 7th abdominal segments.

Abdomen of female oval, much broader than hemelytra at base (34.0: 24.5). Female 8th abdominal tergite and connexival lobes as shown in Fig. 2.

Length of body: 4.8–5.1 mm in male, and 6.0–6.2 mm in female.

Distribution (Map 2): Nova Scotia (without exact locality, Parshley 1921), Quebec, Ontario, New Brunswick, Maine, New Hampshire, Massachusetts, New York, New Jersey, District of Columbia, Virginia, North Carolina, South Carolina, Colorado, Texas, and Mexico.

Associated plants: *Pinus palustris* and *Tsuga* (collected by beating).

Remarks: This species is readily distinguishable from *A.* (*Q.*) *heidemanni* by the thicker antennae and the smaller body.

Aradus (Quilnus) nigrinus canadensis Parshley

(Pl. 2*B*, Fig. 3)

Aradus nigrinus canadensis Parshley, 1929, p. 246.

Color: Black except posterolateral angles of connexival segments, which are dirty yellow.

Structure: Head with median process reaching basal one-quarter of 2nd antennal segment. Relative lengths of antennal segments: 3.0:6.5:7.0: 4.5; 2nd segment as thick as front femora. Postocular lateral margins feebly obtuse. Rostrum reaching posterior end of head.

Pronotum in winged form nearly straight on lateral margin and posterolateral angles broadly rounded. Upper surface of pronotum with median carinae not well marked but distinct, straight, and slightly convergent anteriorly; paramedian carinae indistinct and apparently convergent anteriorly.

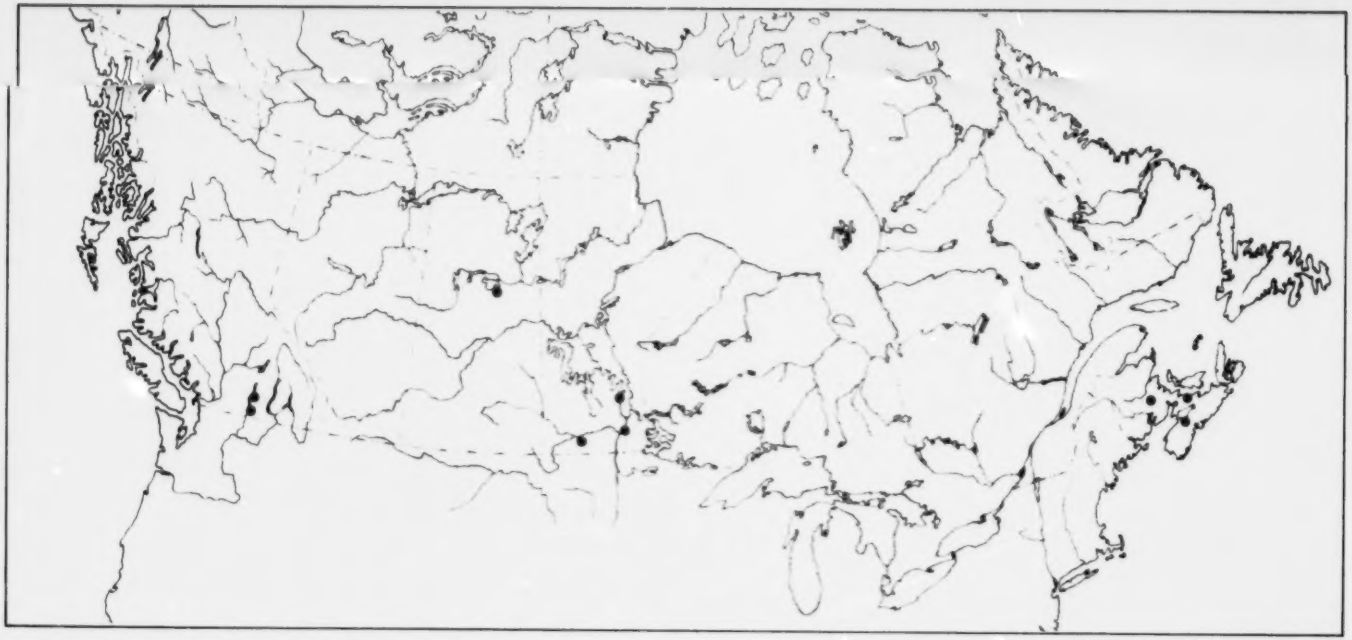
Scutellum with lateral margin distinctly carinated throughout; upper surface with a poorly developed median longitudinal ridge in anterior half, and obscurely transversely rugose in posterior half.

Hemelytra in macropterous form extending slightly beyond posterior margin of 7th abdominal tergite. Abdomen oval. 8th abdominal tergite and connexival lobes as shown in Fig. 3.

Length of body: 5.6 mm in female.

Distribution: Alberta (Banff).

Remarks: This subspecies closely resembles *A. niger* from which, however, it is separable by the more slender antennae, the well-carinated lateral margin of the scutellum, and the different distribution.



Map 3. Distribution of *Aradus cinnamomeus* Panzer in Canada.

Aradus (Aradus) cinnamomeus Panzer

(Pl. 1*C, D, E*, Fig. 2)

Aradus cinnamomeus Panzer, 1794, p. 20.

Color: Predominantly yellowish or reddish brown. Eyes and antennae darker. Posterolateral angles of connexival segments may be pale yellow.

Structure: Head with median process reaching middle of 2nd antennal segment. Antennae short, about half as long as head. Relative lengths of antennal segments: 1.8:3.8:3.0:3.5. Postocular tubercles absent. Rostrum usually extending slightly beyond posterior margin of prosternum.

Pronotum with lateral margin feebly sinuate in anterior half, then rounded posteriorly. Upper surface with median carinae obliterated anteriorly, reaching slightly beyond middle of pronotum; paramedian carinae slightly convergent anteriorly, reaching middle of pronotum; lateral carinae almost obsolete. Transverse depression on pronotum obsolescent; a pair of low calli occur on anterior half of pronotum.

Scutellum elongate subtriangular in shape; lateral margins slightly rounded and posterior end of scutellum broadly rounded; upper surface slightly concave in posterior half.

Hemelytra stenopterous in male (Pl. 1*C*); macropterous (Fig. 1*D*) or brachypterous in various degrees in female, shortest hemelytra (micropterous) extending slightly beyond apex of scutellum (Fig. 1*E*).

Abdomen oval, much wider than hemelytra at base (19.5:15.0 in male, 22.5:19.0 in female). Female 8th abdominal tergite and connexival lobes as shown in Fig. 2.

Length of body: 3.4–4.0 mm in male, and 4.1–5.0 mm in female.

Distribution (Map 3): A holarctic species that occurs in Europe, British Columbia, Manitoba, Saskatchewan, Nova Scotia, New Brunswick, and many states of the USA.

Associated plants: This species is known to infest *Alnus glutinosa, Picea excelsa, Betula alba, Juniperus, Pinus silvestris, Pinus nigra, Pinus contorta, Pinus contorta murrayana, Pinus banksiana, Pinus rigida, Pinus ponderosa, Pinus bolanderi, Pinus sabiniana, Pinus attenuata, Salix, Cupressus sargentii,* and *Abies concolor.*

Remarks: This is the smallest species of *Aradus* in North America. In British Columbia, the apical half of the 3rd antennal segment in this species is yellow, and the species is known as *Aradus (Aradus) cinnamomeus antennalis* Parshley. As can be surmised from the list of host plants, injury to pine trees caused by infestation of this species may be extensive, as described in Europe by Kiritschenko (1913) and Strawinski (1925). This species occurs

on the branches of living pine trees and is said to feed on the juice of the tree, a feeding habit that deviates from that in other species of *Aradus*, which feed on fungi. According to Overgaard (1968), this species is a predator of the southern pine beetle (*Dendroctonus frontalis* Zimmerman) in Texas, Louisiana, and Mississippi; Moser et al. (1971) reported the same association in Texas. Powell (1971) reported the occurrence of this species on the comandra blister rust (*Cronartium comandrae* Pk.) in Alberta. For possible biological control of this bug with fungi, *see* Tanada (1959) and Franz (1961).

Aradus (Aradus) insolitus Van Duzee

(Pl. 2*C*, *D*, Fig. 3)

Aradus insolitus Van Duzee, 1916, p. 233.

Color: Predominantly black. Upper surface of body conspicuously clothed with fine pale granules. Tip of 2nd antennal segment and lateral production of pronotum and posterolateral angles of connexival segments pale yellow.

Structure: Head with median process not reaching basal one-third of 2nd antennal segment. Relative lengths of short antennal segments: 2.3:8.7:4.8:4.7. Postocular lateral margin with an obtuse, ill-defined tubercle. Rostrum reaching middle of prosternum.

Pronotum angularly produced at anterolateral angles; lateral margin of pronotum sinuate in anterior half, straightly convergent posteriorly behind postmedian production. Upper surface of pronotum with median transverse depression not well marked; median carinae convergent medially; paramedian carinae and lateral carinae convergent anteriorly.

Scutellum with lateral margins gently rounded in posterior half or two-thirds; upper surface of scutellum slightly elevated in anterior one-third.

Hemelytra extending slightly beyond posterior margin of 7th tergite in female.

Abdomen as wide medially in male as in female. Connexival segments feebly crenulate. Female 8th abdominal tergite and connexival lobes as shown in Fig. 3.

Length of body: 4.7–4.8 mm in male, and 5.0–5.2 mm in female.

Distribution: British Columbia (Keremeos and Vernon), Alberta (Edmonton), Oregon, and California.

Associated plants: *Salix* and *Stereum hirsutum* fungus on *Populus tremuloides*.

Remarks: The peculiar shape of the pronotum and the small body are highly characteristic.

Aradus (Aradus) aequalis Say

(Pl. 2*E*, *F*, Fig. 3)

Aradus aequalis Say, 1832, p. 352.
Aradus duryi Osborn, 1903, p. 39.

Color: Pale yellow, brown to fuscous in general coloration. Pale yellow on anterior half of lateral margins of pronotum and on hemelytra at base. Fuscous or almost black on anterior and posterior thirds of scutellum, along lateral margins of connexival segments, and at posterior end of corium. Lateral margins of scutellum behind middle and posterolateral angles of connexival segments yellow.

Structure: Upper surface of head clothed with pale tubercles, especially in posterior half. Median process not extending beyond basal one-quarter of 2nd antennal segment. Relative lengths of antennal segments: 3.5:10.5:10.0:7.0. Rostrum extending slightly beyond posterior margin of prosternum.

Pronotum strongly reflected laterally; lateral margin finely and evenly serrulated throughout, straightly divergent from anterior angle to posterior two-fifths, then slightly convergent, ending in broad posterior angles. Upper surface of pronotum with well-marked median carinae convergent at middle and parallel-sided in anterior half; paramedian carinae straightly convergent anteriorly as far as median transverse depression, then divergent anteriorly; lateral carinae obliterated. Median and paramedian carinae clothed with fine pale tubercles.

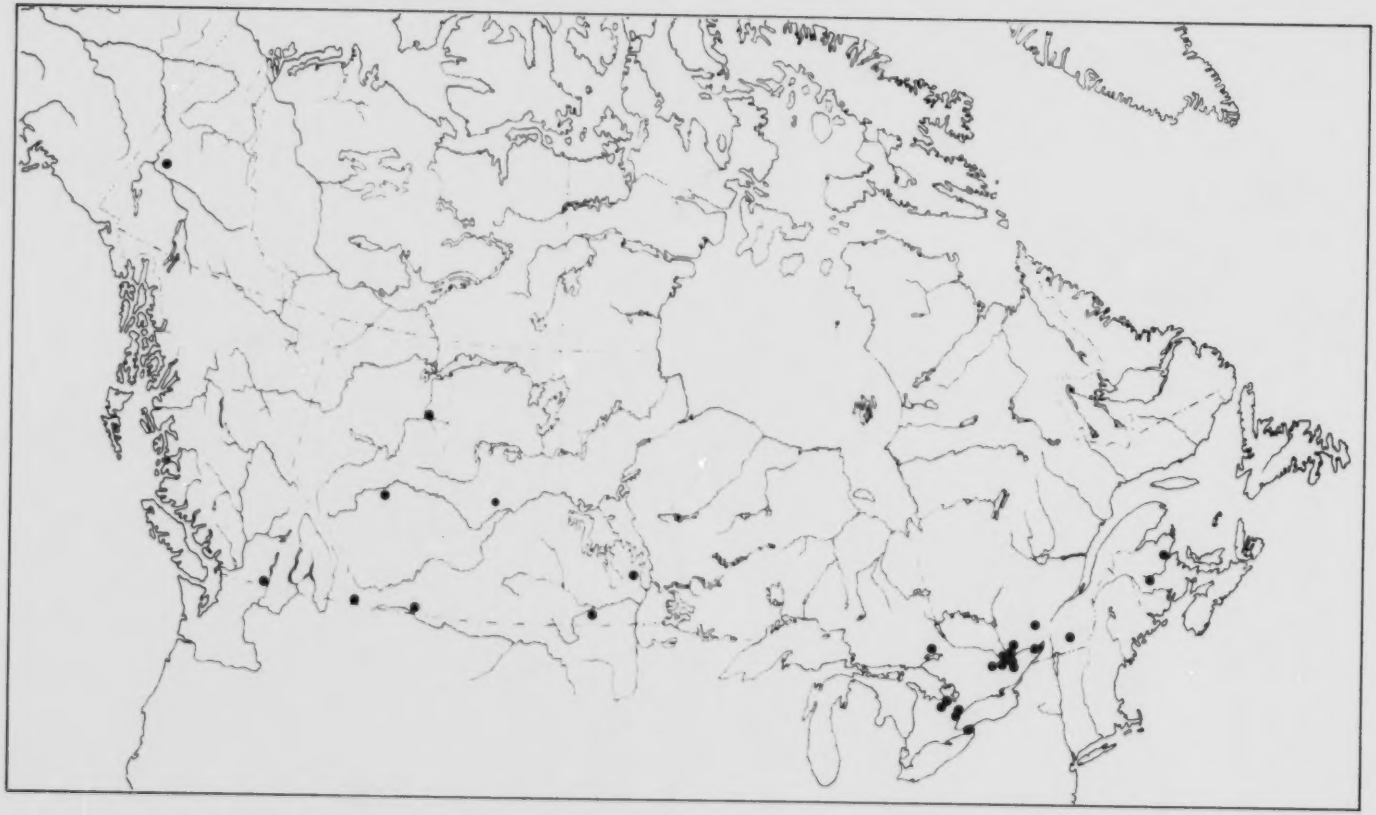
Scutellum longer than pronotum (24:18), and its lateral margins straightly convergent posteriorly, ending in acute tip; upper surface with three longitudinal rows of fine tubercles in anterior one-third.

Hemelytra at base reflected and wider than pronotum behind middle. Abdomen broadly rounded on lateral margins in female. Female 8th abdominal tergite and connexival lobes as shown in Fig. 3.

Length of body: 7.6 mm in male, and 9.3 mm in female.

Distribution: Quebec (Gatineau and Montreal), Ontario (Prince Edward County), New York, Pennsylvania, Maine, District of Columbia, Maryland, Virginia, Ohio, Illinois, Oklahoma, and Texas.

Remarks: The relatively short 2nd antennal segment and almost straight anterolateral and posterolateral margins of the pronotum are characteristic features of this species.



Map 4. Distribution of *Aradus quadrilineatus* Say in Canada.

Aradus (Aradus) quadrilineatus Say

(Pl. 3*B*, *C*, Fig. 4)

Aradus quadrilineatus Say, 1825, p. 326.

Color: Predominantly dark reddish brown to almost black. Lateral area of pronotum and base of hemelytra paler. 2nd antennal segment with apical half yellow and fuscous basally; 3rd and 4th antennal segments black. Posterolateral angles of connexival segments pale brown or yellow; a small black spot on inner half of each connexival segment surrounded by fine pale tubercles. Femora fuscous with a narrow yellow band apically. Tibiae pale yellow, with fuscous median bands.

Structure: Head with median process not extending beyond basal one-fifth of 2nd antennal segment. Relative lengths of antennal segments: 3.3:10.5:8.5:6.7. 2nd segment slender but slightly swollen apically; 3rd segment 1.5 times as thick as 3rd. Rostrum short, not extending beyond posterior margin of prosternum.

Pronotum widest at middle; lateral margin straightly convergent posteriorly behind middle and without conspicuous spines. Upper surface of pronotum with median carinae parallel-sided except middle, where they may be slightly convergent; paramedian carinae slightly convergent anteriorly; lateral carinae obliterated and median transverse depression not deeply marked.

Scutellum with lateral margins well marked and gently marked posteriorly, ending into narrowly rounded apex; upper surface evenly depressed, and with an obscurely defined median longitudinal row of fine tubercles at base.

Hemelytra at base almost as wide as greatest width of pronotum; usually shorter in female than in male, barely reaching posterior margin of penultimate dorsal abdominal segment in some female individuals.

Abdomen in female a little wider than in male, being only slightly wider than pronotum (38:37) in male and significantly wider than pronotum (42:35) in female; posterolateral angles of connexival segments slightly crenulate. Female 8th abdominal tergite and connexival lobes as shown in Fig. 4.

Length of body: 7.2–7.6 mm in male, and 8.0–8.8 mm in female.

Distribution (Map 4): Quebec, Ontario, Manitoba, Yukon Territory, Northwest Territories (Great Bear Lake, not shown on map), British Columbia, Alberta, Saskatchewan, New Brunswick, Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, District of Columbia, Maryland, Virginia, North Carolina, Louisiana, Michigan, Ohio, Indiana, Illinois, Wisconsin, Missouri, Kansas, and Panama.

Associated plants: *Populus, Ulmus, Quercus,* and *Fagus.*

Remarks: The strongly thickened 3rd antennal segment and the strongly expanded median portion of the pronotum are good diagnostic characters of this species.

Aradus (Aradus) gracilis Parshley

(Pl. 9*D*, Fig. 3)

Aradus gracilis Parshley, 1929, p. 245.

Color: Reddish brown in general coloration. Pale yellow on posterolateral angles and along posterior margins of connexival segments. Hemelytra at base paler. Apical third of 2nd antennal segment, 3rd and 4th antennal segments, and lateral margins of connexival segments darker.

Structure: Head with relatively narrow median process reaching basal one-quarter of 2nd antennal segment. Relative lengths of slender antennal segments: 3.2:14.0:5.5:5.5. Postocular lateral margins almost straight and without conspicuous tubercle. Rostrum reaching posterior margin of prosternum.

Pronotum widest in front of middle; lateral margin finely serrulate throughout and without a conspicuous spine, broadly rounded at middle. Upper surface of pronotum with median carinae convergent anteriorly, especially at middle; lateral carinae slightly divergent anteriorly; lateral carinae very short but distinct.

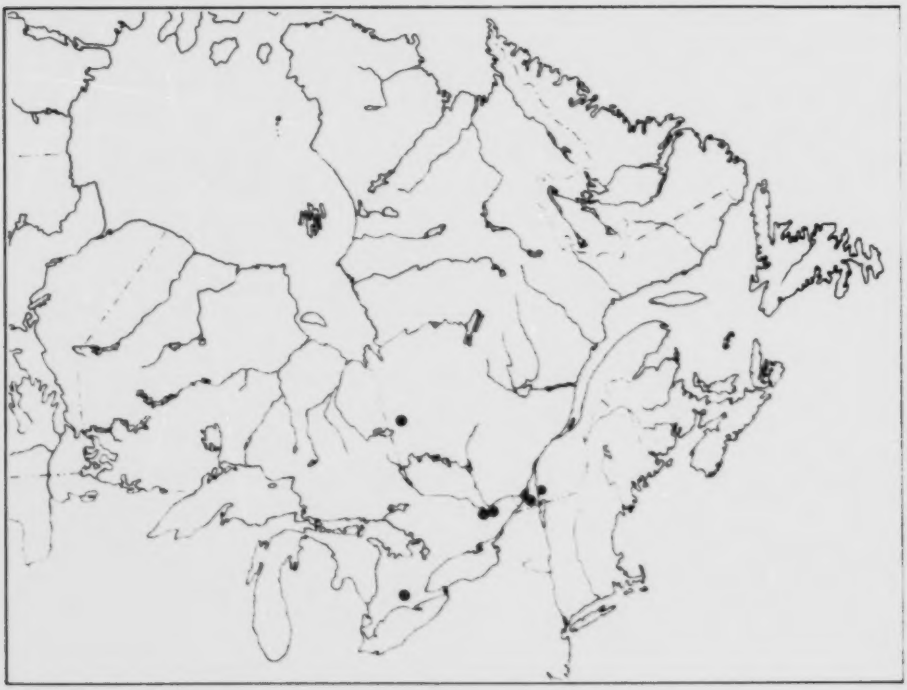
Scutellum relatively narrow; lateral margins straight and parallel-sided in anterior one-third, then almost straightly convergent, ending in acute tip; upper surface with a discoidal elevation in anterior half, the rest transversely rugose. Hemelytra reaching posterior margin of 8th abdominal tergite in female.

Abdomen moderately swollen at middle. Female 8th abdominal tergite and connexival lobes as shown in Fig. 3.

Length of body: 7.5 mm in female.

Distribution: Alberta (Banff).

Remarks: This species is readily identified by its coloration, expanded pronotum, and slender scutellum.



Map 5. Distribution of *Aradus crenatus* Say in Canada.

Aradus (Aradus) crenatus Say

(Pl. 3*D*, *E*, Fig. 4)

Aradus crenatus Say, 1832, p. 350.

Color: Dark to light brown. Antennae pale brown. Pronotum dark except anterolateral pale brown areas. Scutellum with lateral margins almost black except behind middle, where it is pale yellow. Hemelytra pale brown at base, darker posteriorly. Connexival segments dark fuscous at anterolateral and posterolateral angles. Femora dark fuscous with preapical pale brown rings. Tibiae with large median fuscous bands.

Structure: Head with upper surface clothed with pale tubercles. Median process not reaching basal one-quarter of 2nd antennal segment. Each postocular lateral margin obtuse and with few stiff hair-like tubercles. Relative lengths of antennal segments: 4.5:14.5:12.0:9.0. Rostrum not reaching posterior margin of prosternum.

Pronotum widest in front half, with lateral areas widely expanded and moderately reflected, and irregularly teethed on anterior lateral margin. Upper surface of pronotum with transverse depression distinct; median carinae parallel-sided except at middle, where they are slightly convergent; paramedian carinae straight, slightly convergent anteriorly, and not extending beyond transverse depression; lateral carinae short.

Scutellum with lateral margins straight and well carinated, ending in acute tip; basal portion of upper surface very slightly elevated and with low median carina.

Hemelytra at base lobately reflected; apices of hemelytra completely covering genitalia in male, and extending beyond posterior margin of 7th segment in female.

Abdomen oval, broader in female than in male; lateral margin of abdomen crenate. Female 8th abdominal tergite and connexival lobes as shown in Fig. 4.

Length of body: 10.2–10.8 mm in male, and 10.6–10.9 mm in female.

Distribution (Map 5): A wide Nearctic distribution. Quebec, Ontario, many states of the USA, and Mexico.

Associated plants: *Platanus, Pyrus, Quercus, Fagus, Betula, Abies, Acer, Carya, Liriodendron, Carpinus betulus, Salix, Fagus silvatica, Crataegus, Coriolus versicolor, Abies alba, Trametes gibbosa,* and *Polyporus unicolor.*

Remarks: This common species is recognizable by its large size, peculiar antennal structure, and strongly crenate abdomen.

Aradus (Aradus) uniformis Heidemann

(Pl. 3A, Fig. 4)

Aradus uniformis Heidemann, 1904, p. 231.

Color: Predominantly black. 3rd antennal segment pale yellow; other antennal segments black. Posterolateral angles of connexival segments dirty yellow.

Structure: Head with median process reaching basal one-fifth or one-quarter of 2nd antennal segment. Relative lengths of antennal segments: 2.9:8.0:3.8:3.9. Postocular lateral margins straight and without spine. Rostrum clearly not reaching posterior margin of prosternum.

Pronotum widest at middle; anterior half of lateral margin almost straight and spinous behind eye, and posterior half feebly rounded. Upper surface with median carinae subparallel-sided and slightly convergent at middle; paramedian carinae parallel-sided and obliterated beyond middle; lateral carinae distinct.

Scutellum with lateral margins distinctly carinated and slightly curved at middle, and apex broadly rounded; median elevation not so well marked.

Hemelytra reaching apex of abdomen in male, but not reaching apex of abdomen in female.

Abdomen in female much wider than base of hemelytra (32:26); abdomen in male slightly wider than hemelytra at base (28.5:26.0). Female 8th abdominal tergite and connexival lobes as shown in Fig. 4.

Length of body: 5.1 mm in male, and 5.3 mm in female.

Distribution: Ontario (Mer Bleue), Massachusetts, Pennsylvania, Virginia, North Carolina, New York, Maryland, and Florida.

Associated plant: *Pinus*.

Remarks: A rare species that has been found in beach drift.

Aradus (Aradus) martini Matsuda

(Pl. 3*F*, Fig. 5)

Aradus martini Matsuda, 1971, p. 1195.

Color: Predominantly black to blackish brown. 3rd antennal segment pale yellow; 1st and 2nd segments black and 4th segment white pubescent. Posterolateral angles and borders of connexival segments narrow and yellowish brown.

Structure: Head with median process reaching basal one-fifth of 2nd antennal segment. Relative lengths of antennal segments: 3.0:9.0:4.2:4.0. Dorsal surface of head evenly granulated. Rostrum almost reaching posterior margin of prosternum.

Pronotum with lateral margin broadly rounded throughout, and with inconspicuous spine at anterior end of each lateral margin behind eye. Upper surface with median carinae parallel-sided, slightly convergent beyond transverse depression; paramedian carinae slightly convergent anteriorly; lateral carinae distinct.

Scutellum with lateral margins distinctly carinated; upper surface with median elevation inconspicuous.

Hemelytra almost reaching apex of abdomen in female, a little wider at base than width of pronotum (26.5:24.0).

Abdomen a little wider than hemelytra at base in female (27.5:26.5). Female 8th abdominal tergite and connexival lobes as shown in Fig. 5.

Length of body: 5.3 mm in female.

Distribution: Yukon Territory (Swim Lake).

Remarks: This species closely resembles *A. uniformis* Heidemann, but is separable from the latter by the much rounder anterior half of the pronotal lateral margin, the narrower yellowish markings on the connexival segments, the narrower female abdomen, and the different distribution.

Aradus (Aradus) depictus Van Duzee

(Pl. 4*A*, *B*, Fig. 5)

Aradus depictus Van Duzee, 1917*a*, p. 253.

Color: Distinctly variegated. 1st and 2nd antennal segments fuscous; 3rd segment pale yellow except fuscous base; 4th antennal segment black, with apical white pubescence. Upper surface of head fuscous with pale granules; tip of antenniferous tubercle white; eyes black. Pronotum fuscous, with a large white translucent spot along anterolateral margin on each side. Scutellum fuscous with pale granules in anterior two-thirds, black in posterior one-third, and its lateral margin with a white patch at middle. Hemelytra predominantly white, with scattered dark spots. Connexivum largely orange red, nearly black on lateral margin except posterior angle of each connexival segment, which is whitish. Femora and tibiae pale yellow, each with two dark annuli. Under surface of abdomen orange red to yellowish in ground color, with three dark spots in each segment.

Structure: Head with median process reaching basal one-quarter of 2nd antennal segment. Relative lengths of antennal segments: 3.0:10.5:5.8:5.0. 2nd segment distinctly petiolated and slightly constricted in basal part of the segment. Preocular tubercles distinct. Postocular lateral margins almost straight. Rostrum extending slightly beyond posterior margin of prosternum.

Pronotum widest at middle; lateral margin broadly rounded and with several conspicuous spines in anterior half. Upper surface of pronotum moderately elevated in posterior two-thirds; median carinae slightly convergent anteriorly, each with a white tubercle; paramedian carinae slightly convergent anteriorly, and not extending beyond transverse depression; lateral carinae short but distinct.

Scutellum with lateral margins distinctly elevated vertically and slightly rounded, and two lateral margins together ending in acute tip; upper surface slightly elevated and clothed with granules in anterior half, transversely rugose in posterior half.

Hemelytra extending slightly beyond posterior margin of the 7th segment in female.

Abdomen slightly crenulate in posterior connexival segments in both sexes. Female 8th abdominal tergite and connexival lobes as shown in Fig. 5.

Length of body: 5.5 mm in male, and 6.2–6.3 mm in female.

Distribution: British Columbia (Chilliwack, Victoria, and Vancouver), Oregon, and California.

Associated plant: *Quercus* sp.

Remarks: The highly variegated coloration of this species is unique among the North American species of *Aradus*.

Aradus (Aradus) parvicornis Parshley

(Pl. 4*C*, *D*, Fig. 5)

Aradus (Aradus) parvicornis Parshley, 1921, p. 62.

Color: Predominantly dark reddish brown. Posterior half of scutellum, apices of 2nd and 3rd antennal segments, and often carinae of pronotum pale yellowish brown. 4th antennal segment almost black.

Structure: Head with median process robust, extending beyond basal half of 2nd antennal segment. Antennae slender and short; length of antennae slightly less than 1.5 times the width of head across eyes; relative lengths of antennal segments: 2.0:6.0:3.3:4.0. Postocular lateral margins feebly rounded and convergent posteriorly. Rostrum reaching posterior margin of prosternum.

Pronotum widest at middle; lateral margin straightly convergent anteriorly in anterior half, with short distinct spines throughout. Upper surface of pronotum with transverse depression rather indistinct; median carinae almost parallel-sided; paramedian carinae convergent anteriorly; lateral carinae short but distinct.

Scutellum with lateral margins feebly rounded before middle, converging into narrowly rounded apex; upper surface slightly elevated in anterior half, transversely rugose in posterior half.

Hemelytra extending slightly beyond posterior margin of 6th tergite in female, or almost reaching apex of abdomen in male.

Abdomen with connexival segments not crenulate, almost as wide as hemelytra at base in male (20.0:20.5). Female 8th abdominal tergite and connexival lobes as shown in Fig. 5.

Length of body: 4.3–4.5 mm in male, and 5.2 mm in female.

Distribution: British Columbia (Midday Valley), New Mexico, Oregon, and California.

Associated plants: *Polyporus volvatus* on *Pinus ponderosa*, and *Pinus jeffreyi*.

Remarks: The very thick median process of the head and the short, slender antennae are good diagnostic characters that distinguish this species from other species.

Aradus (Aradus) montanus Bergroth

(Pl. 4*E*, *F*, Fig. 6)

Aradus montanus Bergroth, 1913, p. 1.

Color: Unicolorous, dark reddish brown to almost black.

Structure: Head with median process extending slightly beyond basal petiole of 2nd antennal segment. Antennae rather thick; relative lengths of antennal segments: 4.5:10.0:7.0:6.0. Upper surface of head finely granulated. Postocular tubercles spinous. Rostrum short, not reaching posterior border of prosternum.

Pronotum with lateral margin on each side irregularly denticulated, but broadly rounded behind robust and prominent anterior end. Upper surface of pronotum with median carinae straight, slightly convergent anteriorly; paramedian carinae parallel with median carinae, and obliterated beyond median transverse depression; lateral carinae indistinct.

Scutellum with lateral margins strongly convergent in posterior two-thirds, ending in rather broadly rounded tip. Hemelytra not reaching apex of abdomen in either sex.

Abdomen with connexival segments feebly crenulate in male. Female 8th abdominal tergite and connexival lobes as shown in Fig. 6.

Length of body: 7.7 mm in male, and 8.3 mm in female.

Distribution: Quebec (St. Hilaire), Montana, and Colorado.

Remarks: The rather thick antennae and the prominent anterolateral angles of the pronotum are diagnostic characters of this species.

Aradus (Aradus) intectus Parshley

(Pl. 5*A–C*, Fig. 6)

Aradus (Aradus) intectus Parshley, 1921, p. 42.

Color: Black to blackish brown except posterolateral angles of connexival segments that often may be whitish or pale yellow.

Structure: Head with median process narrowed anteriorly, reaching basal one-fifth of 2nd antennal segment. Relative lengths of rather thick

antennal segments: 3.5:8.5:6.2:5.7. Postocular lateral margins substraight, without spine or tubercle. Rostrum clearly extending beyond posterior border of prosternum.

Pronotum widest slightly behind the middle; lateral margin serrulate and feebly sinuate in anterior half. Upper surface of pronotum without distinct median transverse depression; median carinae almost parallel-sided; paramedian carinae slightly convergent anteriorly; lateral carinae indistinct.

Scutellum elongate; lateral margins almost parallel-sided in anterior one-third, and merging into narrowly rounded apex; upper surface with a slight median elevation, and transversely rugose in posterior half.

Hemelytra brachypterous in female and reaching posterior margin of 6th abdominal tergite (Pl. 5*C*).

Abdomen strongly widened behind middle. Connexival segments not crenulate. Line separating female 8th abdominal tergite from connexival lobes absent.

Length of body: 5.1–5.5 mm in male, and 5.7–6.0 mm in female.

Distribution: British Columbia (Oliver), Yukon Territory (Barret), Manitoba (Aweme), Wyoming, and Colorado.

Remarks: This species is provisionally retained as distinct from *A. robustus* Uhler, as discussed on p. 41.

Aradus (Aradus) saileri Kormilev

(Pl. 7*B*, Fig. 8)

Aradus saileri Kormilev, 1966*b*, p. 2.

Color: Uniformly black except posterior margins of connexival segments, which are dirty yellow.

Structure: Head with median process narrowed anteriorly, reaching basal one-quarter of 2nd antennal segment. Postocular lateral margins without spine or tubercle. Antennae rather thick; relative lengths of antennal segments: 3.0:7.5:5.5:4.0. Rostrum extending beyond posterior margin of prosternum.

Pronotum widest behind middle; lateral margin finely tuberculate and feebly sinuate in anterior half. Upper surface of pronotum with median carinae subparallel-sided and well marked; paramedian carinae obliterated anteriorly; lateral carinae obliterated.

Scutellum with lateral margins parallel-sided in anterior one-third, then converging posteriorly, ending in broadly rounded apex; upper surface with a small elevation at middle.

Hemely
middle in m elytra not reaching tip of abdomen in male. Abdomen widened at
male.

Length
th of body: 5.0 mm in male.

Distribu
ibution: Alaska (Riverside, Tanana River).

Remark
and may be arks: This species very closely resembles *Aradus intectus* Parshley,
A. intectus P be synonymized with it in the future. In the key it keys out to
s Parshley and *A. saileri* Kormilev.

Aradus (Aradus) duzeei Bergroth

(Pl. 5*D*, *E*, Fig. 6)

Aradus
s duzeei Bergroth, 1892, p. 333.

Color:
dull yellow. F Predominantly fuscous to almost black. 1st antennal segment
of hemelytra, . Posterolateral angle of pronotum, apex of scutellum, large part
mostly pale yra, and posterolateral angles of connexival segments yellow. Legs
yellow; basal parts of tibiae darker.

Structure
one-fifth of 2re: Head with median process relatively slender, reaching basal
3.5:10.5:6.8: 2nd antennal segment. Relative lengths of antennal segments:
Postocular la 8:6.0; 2nd and 3rd segments clothed with stiff hair-like tubercles.
posterior mar lateral margin obtusely rounded. Rostrum not quite reaching
argin of prosternum.

Pronotun
Upper surface um broadest behind middle; lateral margin without denticulation.
parallel-sided; ce of pronotum strongly reflected laterally; median carinae almost
extending beyd; paramedian carinae feebly convergent anteriorly and not
eyond median transverse depression; lateral carinae indistinct.

Scutellum
straight, mergum relatively long; lateral margins well carinated and almost
anterior one-th rging into a rather narrow apex; upper surface granulated in
-third and the rest transversely rugose.

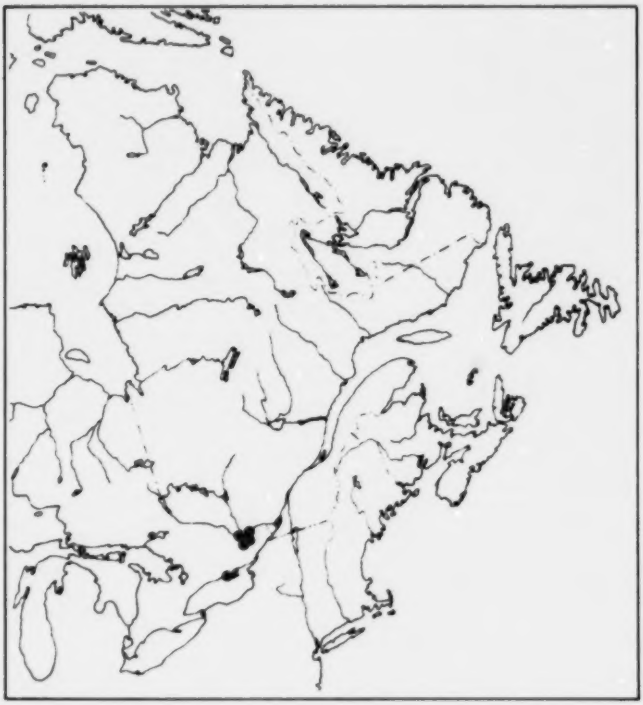
Hemelytra
Abdomen with tra extending beyond posterior margin of 7th tergite in female.
abdominal terg ith posterior connexival segments slightly crenulate. Female 8th
ergite and connexival lobes as shown in Fig. 6.

Length of
of body: 6.1–6.5 mm in female.

Distributi
Maryland, Mas tion: Quebec (Montreal), Ontario (Muskoka, Ridgeway),
Virginia. lassachusetts, Pennsylvania, New York, New Jersey, Ohio, and

Associatec
ted plants: *Pinus*, *Fagus*, and *Acer*.

Remarks:
is separable fro s: This species closely resembles *A. implanus* Parshley, but
from the latter as shown in the key.



Map 6.
Distribution of
Aradus implanus
Parshley in Canada.

Aradus (Aradus) implanus Parshley

(Pls. 5*F*, 6*A*, Fig. 7)

Aradus (Aradus) implanus Parshley, 1921, p. 45.

Color: Head including antennae densely clothed with dirty yellow tubercles except 4th antennal segment. Pronotum with a white spot along anterior lateral margin on each side. Apex of scutellum pale yellow. Hemelytra mostly whitish on either side of scutellum. Connexivum mostly reddish along hemelytra, and dark on lateral margins; posterior angles of connexival segments paler. Femora and tibiae mostly fuscous, with a pale yellow band near apex of each femur and at base of each tibia.

Structure: Head with median process reaching basal one-quarter of 2nd antennal segment. Antennae thick; relative lengths of antennal segments: 3.2:11.5:7.8:6.8; 2nd and 3rd segments clothed with short, stiff hair-like tubercles. Postocular lateral margin obtuse. Rostrum reaching or almost reaching posterior border of prosternum.

Pronotum widest at middle; lateral margin finely serrulate, and sinuate behind anterolateral angles. Upper surface of pronotum with median carinae

almost straight and slightly convergent anteriorly; paramedian carinae straight and slightly convergent anteriorly, obliterated beyond middle; lateral carinae obliterated.

Scutellum with lateral margins well elevated and straight, ending in narrowly rounded apex; upper surface depressed except at base.

Hemelytra reflexed, almost reaching posterior end of abdomen in male; extending slightly beyond anterior margin of 8th abdominal tergite in female.

Abdomen wider than hemelytra at base (29:25 in male, 37:29 in female). Posterior angles of connexival segments feebly obtusely produced in male. Female 8th abdominal tergite and connexival lobes as shown in Fig. 7.

Length of body: 5.7–6.2 mm in male, and 6.0–6.7 mm in female.

Distribution (Map 6): Ontario, Quebec, Pennsylvania, Illinois, Indiana, and Michigan.

Remarks: This species closely resembles *A. duzeei*, but is distinguishable from the latter by the thicker antennae and the different shape and color pattern of the pronotum.

Map 7.
Distribution of
Aradus behrensi
Bergroth in Canada

Aradus (Aradus) behrensi Bergroth

(Pl. 6*B*, *C*, Fig. 7)

Aradus behrensi Bergroth, 1886, p. 97.

Color: Predominantly brown to reddish brown. Base of hemelytra, apex of scutellum, and posterolateral angles of connexival segments yellow. Posterior margin of pronotum on both sides of scutellum narrow and yellow in some individuals. Femora and tibiae yellow, each with a wide, median fuscous band.

Structure: Head with median process reaching one-quarter of 2nd antennal segment; upper surface densely clothed with fine dirty yellow tubercles. Antennae thick; relative lengths of antennal segments: 3.3:9.2:6.0:5.0. Postocular tubercles obtuse. Rostrum clearly extending beyond posterior margin of prosternum, especially in male.

Pronotum widest at middle; lateral margin of pronotum almost straight and obscurely denticulated in anterior half. Upper surface of pronotum with median carinae clearly convergent anteriorly; paramedian carinae subparallel, distinctly extending beyond median transverse depression, which is poorly marked; lateral carinae obliterated.

Scutellum with lateral margin slightly rounded and distinctly elevated in anterior half; upper surface distinctly elevated and granulated in anterior one-third; rest of upper surface transversely rugose.

Hemelytra almost reaching posterior end of body in male, extending slightly beyond posterior margin of 7th abdominal tergite in female.

Abdomen oval and strongly widened medially in female. Connexival segments not crenulate. Female 8th abdominal tergite and connexival lobes as shown in Fig. 7.

Length of body: 5.2–5.4 mm in male, and 5.4–5.6 mm in female.

Distribution (Map 7): British Columbia, Oregon, Washington, and California.

Associated plants: *Pinus ponderosa* and *Quercus kelloggi*.

Remarks: This species is separable from the closely related species *A. fuscomaculatus* as shown in the key.

Map 8.
Distribution of
Aradus fuscomaculatus
Stål in Canada.

Aradus (Aradus) fuscomaculatus Stål

(Pl. 6*D*, *E*, Fig. 7)

Aradus fuscomaculatus Stål, 1859, p. 260.

Color: Predominantly fuscous. Pale yellow at base of each hemelytron and at apex of scutellum. Posterior margin of pronotum on both sides of scutellum, and anteriormost denticle of pronotal lateral margin pale yellow. Connexivum predominantly reddish brown in some specimens; posterolateral angles of connexival segments pale. Femora and tibiae pale yellow, each femur and each tibia with a broad median fuscous band.

Structure: Head with median process reaching basal one-quarter of 2nd antennal segment. Relative lengths of antennal segments: 3.5:11.0:6.8:6.0. 2nd segment rather thick; its basal one-third narrowed on inner margin; 3rd segment as thick as anterior two-thirds of 2nd segment. Upper surface of head evenly granulated. Postocular tubercle obtusely rounded. Rostrum extending beyond posterior border of prosternum.

Pronotum widest at middle; anterior half of lateral margin distinctly denticulated. Upper surface of pronotum with median carinae well marked,

and convergent at middle; paramedian carinae almost parallel-sided and well marked; lateral carinae distinct and convergent as far as median transverse depression, which is not well marked.

Scutellum with lateral margins distinctly elevated throughout, parallel-sided in anterior one-third and then converging posteriorly, ending in acute tip; upper surface of scutellum evenly granulated and elevated in anterior one-quarter.

Hemelytra completely covering genitalia in male, or reaching middle of 8th abdominal tergite in female.

Abdomen wider than hemelytra (37:29 in female, 30:28 in male). Posterolateral angles of connexival segments not crenulate. Female 8th abdominal tergite and connexival lobes as shown in Fig. 7.

Length of body: 5.5 mm in male, and 7.0–7.3 mm in female.

Distribution (Map 8): British Columbia, Washington, Oregon, and California.

Associated plants: *Picea sitchensis*, *Quercus*, *Abies concolor*, *Abies grandis*, *Pinus jeffreyi*, and *Pinus ponderosa*. Caught by a light trap in British Columbia.

Remarks: This species resembles *A. behrensi*, but the two species are separable by the characters of the scutellum as shown in the key.

Map 9. Distribution of *Aradus robustus* Uhler in Canada.

Aradus (Aradus) robustus Uhler

(Pls. 6F, 7A, Fig. 8)

Aradus robustus Uhler, 1886, p. 104.

Color: Predominantly dark brown to black. Base of hemelytra pale yellow. Connexivum mostly reddish brown, with black lateral margin. Tibia yellow with a broad fuscous band.

Structure: Head a little wider than long. Median process reaching basal one-quarter of 2nd antennal segment. Relative lengths of antennal segments: 3:9:6:5; 2nd and 3rd segments clothed with stiff hair-like tubercles; 2nd segment distinctly petiolated at base. Postocular tubercles rounded. Rostrum reaching posterior margin of prosternum.

Pronotum widest at middle; lateral margin of pronotum broadly rounded and with few inconspicuous spines anteriorly. Upper surface of pronotum with median carinae gently divergent in posterior half; paramedian carinae almost parallel-sided and extending beyond middle of pronotum; lateral carinae convergent anteriorly, median transverse depression indistinct.

Scutellum 1.5 times as long as wide at base (15.5:10.5); its lateral margins gently rounded; upper surface slightly elevated and finely granulated on anterior one-third.

Hemelytra almost reaching apex of body in male, and extending slightly beyond posterior margin of 7th segment in female.

Abdomen moderately swollen at middle. Connexival segments distinctly crenulate. Female 8th abdominal tergite and connexival lobes as shown in Fig. 8.

Length of body: 5.6–6.0 mm in male, and 6.3–6.7 mm in female.

Distribution (Map 9): Quebec, Ontario, and many states of the USA.

Associated plant: *Quercus* sp.

Remarks: This species resembles *A. intectus* Parshley more closely than other related species with the thick antennae in having the unicolorous scutellum, but the two species are separable as shown in the key.

Aradus (Aradus) approximatus Parshley

(Pl. 7C, D, Fig. 8)

Aradus (Aradus) approximatus Parshley, 1921, p. 72.

Color: Yellowish brown to dark brown in ground color, strewn with fine white tubercles, especially on head, pronotum, scutellum, and connexivum. Apical portion of 2nd antennal segment and 3rd and 4th antennal segments darker.

Structure: Head with median process not quite reaching basal one-third of 2nd antennal segment. Relative lengths of antennal segments: 4.0:19.0:6.0:6.5. 2nd antennal segment abruptly and strongly swollen in apical one-quarter. Postocular lateral margin rectangularly produced. Rostrum reaching or extending slightly beyond middle of mesosternum.

Pronotum relatively narrow and widest at middle; lateral margin broadly rounded, and with some distinct spines in anterior half. Upper surface of pronotum with shallow median transverse depression; median carinae straight; paramedian carinae distinctly convergent anteriorly; lateral carinae just reaching median transverse depression.

Scutellum rather short, broad, and subtriangular in shape; upper surface with an obscure median elevation.

Hemelytra wider at base than pronotum at middle (40:34), their apices reaching or almost reaching posterior margin of 7th tergite in female.

Abdomen feebly crenulate on connexivum, more so in male than in female. Female 8th abdominal tergite and connexival lobes as shown in Fig. 8.

Length of body: 9.7 mm in male, and 9.7–10.0 mm in female.

Distribution: Quebec (Kazabazua), Mississippi, Maine, Indiana, New Jersey, New York, and Georgia.

Associated plant: *Pinus* sp.

Remarks: This species has hitherto been known only from the USA. The species closely resembles *A. inornatus* Uhler, but is separable from the latter by the narrower pronotum, broader scutellum, and more strongly swollen apical part of the 2nd antennal segment.

Map 10. Distribution of *Aradus inornatus* Uhler in Canada.

Aradus (Aradus) inornatus Uhler

(Pl. 7*E*, *F*, Fig. 9)

Aradus inornatus Uhler, 1876, p. 323.

Color: Somewhat variable in color, ranging from predominantly reddish brown to almost black. Connexivum often with yellow markings, which may be ill-defined and often indistinct in female. 2nd antennal segment almost black toward apex; 3rd and 4th antennal segments almost black except apex of 4th, which is white pubescent. Anterolateral areas of pronotum and base of hemelytra paler.

Structure: Head with median process almost reaching basal one-third of 2nd antennal segment. Relative lengths of antennal segments: 4:20:6:6. Postocular lateral margins with a small tubercle on each side. Rostrum reaching or extending slightly beyond middle of mesosternum.

Pronotum widest at middle; anterior lateral margin of pronotum with distinct spines, and broadly rounded at middle. Upper surface of pronotum with a shallow median transverse impression and sides scarcely reflected; median carinae feebly convergent in anterior half; paramedian carinae clearly convergent anteriorly; short lateral carinae distinctly recognizable.

Scutellum with lateral margins feebly rounded in anterior half, then convergent posteriorly; upper surface slightly elevated in anterior half; transversely rugose in posterior half.

Hemelytra just reaching posterior margin of 7th abdominal tergite.

Abdomen with connexival segments slightly crenulate in male. Posterior part of abdomen strongly narrowed in female. Female 8th abdominal tergite and connexival lobes as shown in Fig. 9.

Length of body: 10.4–10.7 mm in male, and 11.8–13.0 mm in female.

Distribution (Map 10): Quebec, Ontario, Manitoba, and the Northern half of the eastern USA.

Remarks: In *A. inornatus* the pronotum is more rounded on the lateral margin and more even on the surface than in *A. blaisdelli*. *A. inornatus* is known from eastern North America, whereas *A. blaisdelli* is a western species (British Columbia and Saskatchewan).

Aradus (Aradus) acutus Say

(Pl. 8A, B, Fig. 9)

Aradus acutus Say, 1832, p. 351.

Color: Predominantly blackish brown to black, surface strewn with fine whitish granules, forming a distinct pattern especially inside connexivum. Posterior margins of connexival segments pale yellow.

Structure: Head with median process reaching basal one-quarter of 2nd antennal segment. Upper surface of head densely clothed with fine whitish granules. Relative lengths of antennal segments: 3.0:17.0:5.8:6.0; 2nd segment progressively thicker anteriorly. Rostrum extending slightly beyond posterior margin of prosternum. Each postocular lateral margin with a minute projection.

Pronotum with lateral margin broadly rounded and widest at middle, with a few rather conspicuous spines in their anterior halves. Upper surface of pronotum with median carinae subparallel-sided, slightly convergent anteriorly; paramedian carinae convergent anteriorly; lateral carinae distinct. Median transverse depression shallowly marked.

Scutellum with lateral margins convergent in posterior two-thirds, together ending in broadly rounded apex; upper surface elevated in anterior half.

Hemelytra extending slightly beyond posterior margin of 6th abdominal segment in female. Female 8th abdominal tergite and connexival lobes as shown in Fig. 9.

Length of body: 7.2–8.0 mm in male, and 8.2–9.1 mm in female.

Distribution: Maine, New Hampshire, District of Columbia, Delaware, Maryland, Pennsylvania, Virginia, North Carolina, Georgia, Alabama, Florida, Ohio, Indiana, Missouri, Mississippi, Kansas, Arkansas, Texas, Montana, Washington, and California.

Associated plant: *Quercus nigra*.

Remarks: This common species is unique in having silvery spots on abdominal tergites along the connexivum.

Aradus (Aradus) paganicus Parshley

(Pl. 8C, D, Fig. 9)

Aradus paganicus Parshley, 1929, p. 244.

Color: Light brown to fuscous. Head, anterior half of 2nd antennal segment, 4th antennal segment, pronotum except lateral margin, membrane of hemelytra, and femora darker. Upper surface of body sparsely clothed with fine pale granules.

Structure: Head with median process reaching basal one-fifth of 2nd antennal segment. Relative lengths of antennal segments: 4.0:17.5:5.8:5.0. 2nd antennal segment progressively thicker anteriorly. Postocular tubercle subrectangularly produced. Rostrum reaching middle of mesosternum.

Pronotum widest behind middle; lateral margin slightly reflected. Upper surface of pronotum with a distinct transverse depression; median carinae strongly bulged behind middle; paramedian carinae convergent anteriorly; lateral carinae clearly marked, but not reaching median transverse depression.

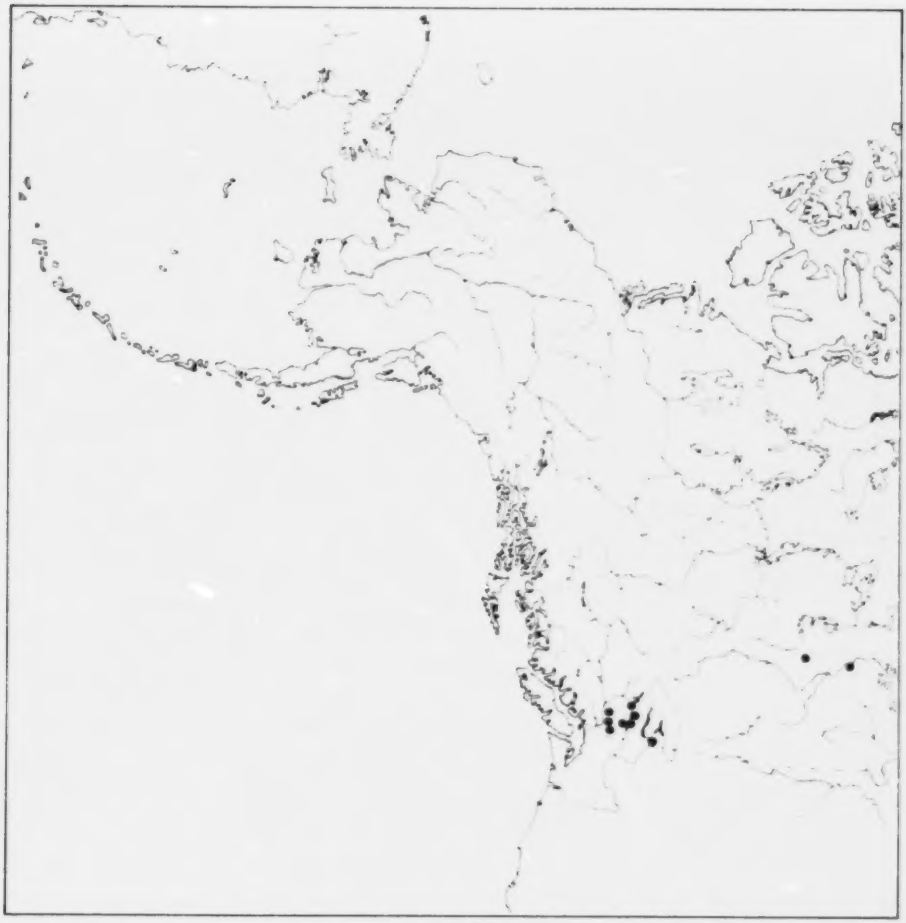
Scutellum with lateral margins parallel-sided in anterior one-third, and then convergent posteriorly; upper surface with a median elevated area.

Hemelytra slightly reflected at base, their apices completely covering genitalia in male or extending beyond posterior margin of 6th abdominal tergite in female. Abdomen oval; posterior angles of connexival segments not crenulated. Female 8th abdominal tergite and connexival lobes as shown in Fig. 9.

Length of body: 8.0–8.5 mm in male, and 9.0–9.5 mm in female.

Distribution: British Columbia (Vermont, Victoria, Penticton, and Kelowna).

Remarks: This species is closely related to *A. acutus*, but it can be separated from the latter by the duller general coloration and the bulged median carinae of the pronotum.



Map 11. Distribution of *Aradus blaisdelli* Van Duzee in Canada.

Aradus (Aradus) blaisdelli Van Duzee

(Pl. 8*E*, *F*, Fig. 10)

Aradus (Aradus) blaisdelli Van Duzee, 1920, p. 333.

Color: Reddish brown to nearly black. Lateral area of pronotum and base of hemelytra paler. Each connexival segment with an obscure yellow spot.

Structure: Head with median process reaching basal one-third of 2nd antennal segment. Relative lengths of antennal segments: 3.2:22.0:6.2:6.0. Postocular lateral margin with a distinct projection. Rostrum reaching or extending beyond middle of mesosternum.

Pronotum reflected laterally, widest and not smoothly rounded at middle; anterior half of lateral margin of pronotum with several distinct spines. Upper surface of pronotum uneven; median carinae subparallel; paramedian carinae convergent anteriorly beyond median transverse depression; lateral carinae distinct.

Scutellum with lateral margins broadly rounded except at base; upper surface with a low median elevation. Hemelytra reaching middle or posterior margin of 7th segment in female, and completely covering genitalia in male. Female 8th abdominal tergite and connexival lobes as shown in Fig. 10.

Length of body: 8.6 mm in male, and 10.0–10.8 mm in female.

Distribution (Map 11): British Columbia, Saskatchewan, Washington, Montana, and Oregon.

Associated plants: *Poria* fungus on *Pinus ponderosa* and *Abies concolor*.

Remarks: This species is distinguishable from *A. inornatus* Uhler as shown in the key.

Aradus (Aradus) opertaneus Parshley

(Pl. 9A, Fig. 10)

Aradus (Aradus) opertaneus Parshley, 1921, p. 63.

Color: Predominantly dark brown. Hemelytra paler at base; posterior angles of connexival segments indistinctly yellowish.

Structure: Head with median process reaching basal one-third of 2nd antennal segment. Relative lengths of antennal segments: 3.2:13.0:6.5:6.0. Postocular lateral margins obtusely rounded. Rostrum reaching middle of prosternum.

Pronotum widest behind middle; lateral margin of pronotum obscurely denticulate in anterior half. Upper surface of pronotum with median transverse depression rather shallow; median carinae parallel-sided, paramedian carinae convergent anteriorly; lateral carinae obliterated.

Scutellum broadly triangular; sides and upper surface very little elevated, and apex narrowly rounded.

Hemelytra extending slightly beyond posterior margin of 7th abdominal tergite.

Abdomen in female much broader than pronotum and oval in shape; posterolateral angles of connexival segments feebly crenulate. Female 8th abdominal tergite and connexival lobes as shown in Fig. 10.

Length of body: 6.5–7.1 mm in female.

Distribution: Known only from Minnesota (Cass County).

Remarks: This species resembles *A. proboscideus* and *A. similis*, but the short rostrum, which reaches only the middle of the prosternum, distinguishes this species readily from them. Only the female is known.

Aradus (Aradus) lawrencei Kormilev

(Pl. 9*B*)

Aradus lawrencei Kormilev, 1966*a*, p. 27.

Color: Dark reddish brown to nearly black in ground color. Posterior halves of connexival segments yellowish brown.

Structure: Head with median process reaching basal one-quarter of 2nd antennal segment. Relative lengths of antennal segments: 2.8:11.5:5.8:5.5. Postocular lateral margins with a minute tubercle immediately behind each eye. Rostrum short, reaching middle of prosternum.

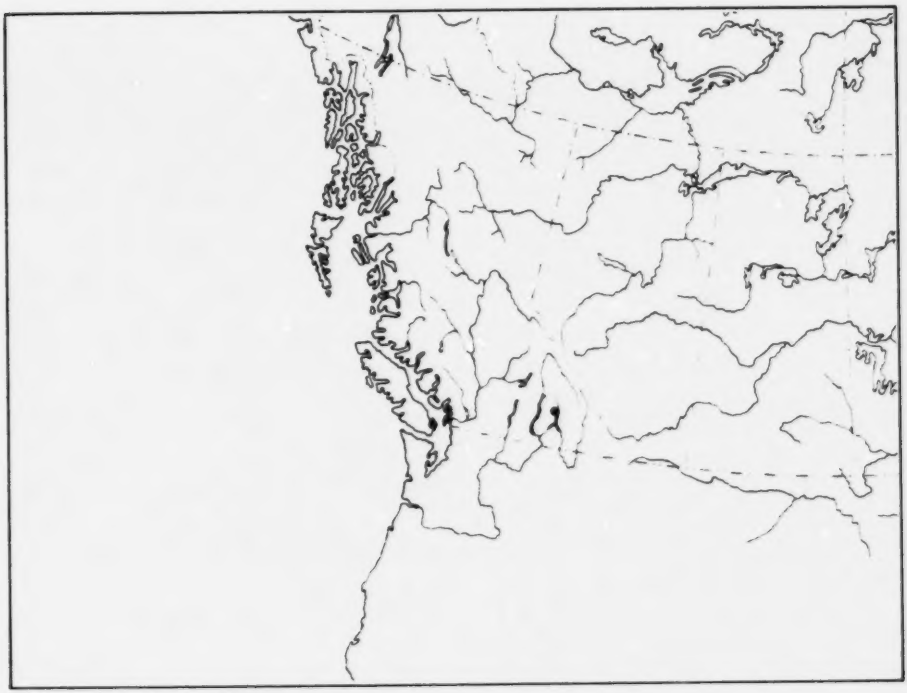
Pronotum with lateral margin broadly rounded and distinctly denticulated. Upper surface of pronotum with median carinae parallel-sided; paramedian carinae slightly convergent anteriorly.

Hemelytra at base a little broader than pronotum at middle. Abdomen obovate, posterolateral angles of connexival segments not crenulate in male.

Length of body: 5.5 mm in male.

Distribution: New Hampshire (Wilton and Hilsboro County).

Remarks: This species may be a synonym of *A. opertaneus*. In the key this species keys out to *A. opertaneus* Parshley.



Map 12. Distribution of *Aradus compressus* Heidemann in Canada.

Aradus (Aradus) compressus Heidemann

(Pl. 9C, Fig. 10)

Aradus compressus Heidemann, 1907, p. 70.

Color: Predominantly dark brown to black. Posterior half of lateral margin of pronotum and posterolateral angles of connexival segments pale yellow. Legs predominantly dark brown.

Structure: Head with slender median process reaching basal one-quarter of 2nd antennal segment, and its apex as thick as apex of 2nd antennal segment. Relative lengths of antennal segments: 4.0:18.0:8.5:6.2. Postocular lateral margins smooth, and without tubercles. Rostrum extending slightly beyond posterior margin of prosternum.

Pronotum widest behind middle. Pronotal lateral margin finely serrulate and without conspicuous spines, slightly sinuate in anterior half; anterolateral angle of pronotum obtusely produced. Upper surface of pronotum without distinct median transverse impression; median and paramedian carinae

straight and parallel, convergent anteriorly; lateral carinae obscure, convergent anteriorly.

Scutellum elongate and its lateral margins subparallel-sided in anterior one-third; upper surface of scutellum with a low median elevation, transversely rugose in posterior half.

Hemelytra reaching posterior end of body in male, extending slightly beyond posterior margin of the 7th tergite in female.

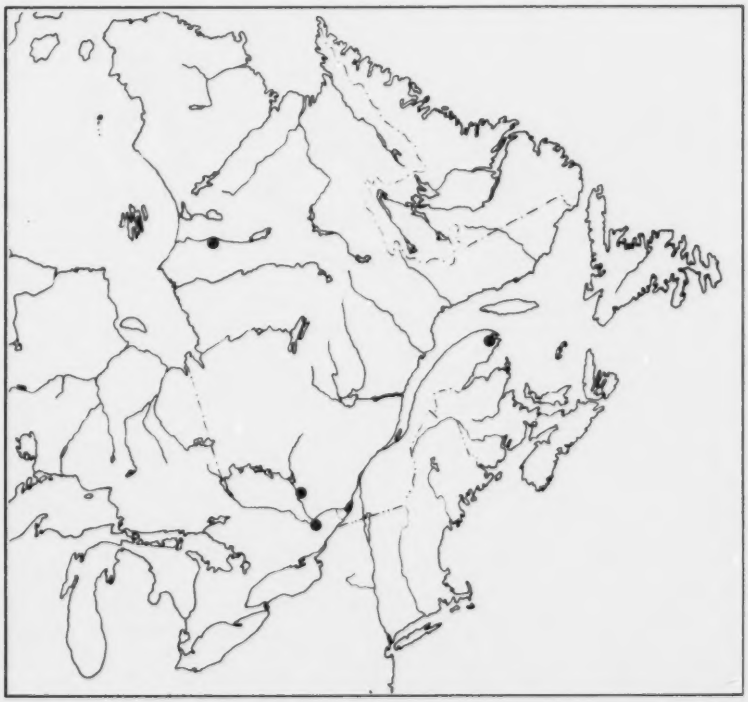
Abdomen wider than hemelytra at base in female. Posterolateral angle of 6th connexival segment produced in both sexes. Female 8th abdominal tergite and connexival lobes as shown in Fig. 10.

Length of body: 7.5 mm in male, and 9.5 mm in female.

Distribution (Map 12): British Columbia, Washington, Oregon, and California.

Associated plant: *Pinus contorta murrayana.*

Remarks: The difference between this species and the closely related *A. borealis* Heidemann is small, as shown in the key.



Map 13. Distribution of *Aradus borealis* Heidemann in Canada.

Aradus (Aradus) borealis Heidemann

(Pl. 9*E*, *F*, Fig. 11)

Aradus borealis Heidemann, 1909, p. 190.
Aradus borealis: Parshley, 1921, p. 74.

Color: Dark reddish brown to black. Posterior angles of connexival segments yellow. Apical margin of scutellum pale yellow.

Structure: Head with median process narrow, about as thick as apical portion of 2nd antennal segment. Relative lengths of antennal segments: 3.2:12.5:5.7:4.8. Postocular tubercle absent. Rostrum clearly extending beyond posterior margin of prosternum.

Pronotum with lateral margin without conspicuous spine, broadly rounded in posterior half, and substraight in anterior half. Upper surface of pronotum with median carinae slightly convergent anteriorly; paramedian carinae slightly convergent anteriorly or almost parallel-sided, then slightly divergent and obliterated in anterior half of pronotum; lateral carinae convergent, and median transverse depression shallow.

Scutellum elongate subtriangular in shape; lateral margins strongly elevated and may be parallel-sided in anterior one-third; upper surface without conspicuous elevation and transversely rugose in posterior half.

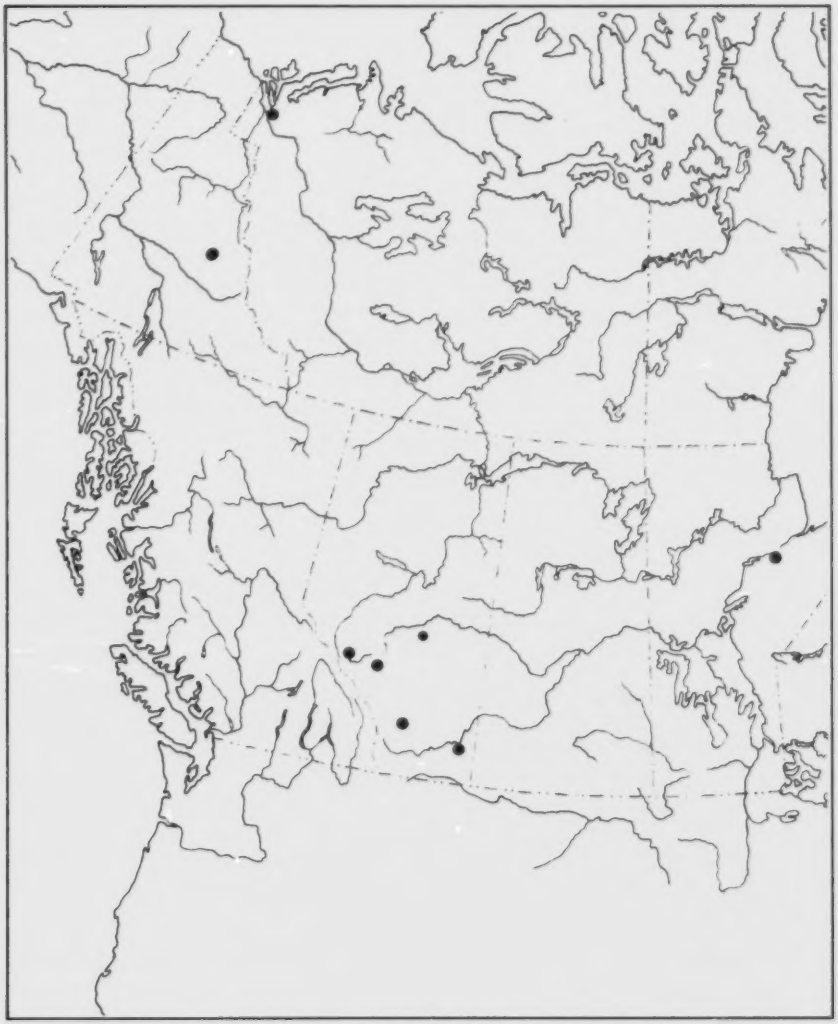
Hemelytra reaching base of 8th abdominal tergite in female.

Abdomen much broader than hemelytra in female (40:34). Female 8th abdominal tergite and connexival lobes as shown in Fig. 11.

Length of body: 7.2–7.4 mm in male, and 7.4–8.0 mm in female.

Distribution (Map 13): Quebec, Ontario, Saskatchewan (Saskatchewan River, Parshley 1921, not on the map), Maine, New Hampshire, Michigan, and California.

Remarks: To distinguish this species from *A. compressus*, see the key.



Map 14. Distribution of *Aradus uniannulatus* Parshley in Canada.

Aradus (Aradus) uniannulatus Parshley

(Pl. 10*A*, *B*, Fig. 11)

Aradus (Aradus) uniannulatus Parshley, 1921, p. 90.

Color: Predominantly black dorsally. 3rd antennal segment pale yellow in apical one-third. Lateral margin of pronotum reddish brown. Connexival

segments reddish brown except posterior margins, which are pale yellow. Hemelytra brown to reddish brown, and pale on lateral margins. Under surface of body and legs reddish brown; head and pronotum darker.

Structure: Head with median process thick, just reaching basal one-quarter of 2nd antennal segment. Antennae slender. Relative lengths of antennal segments: 1.8:8.5:3.8:3.3. Postocular tubercles absent. Rostrum reaching middle of mesosternum.

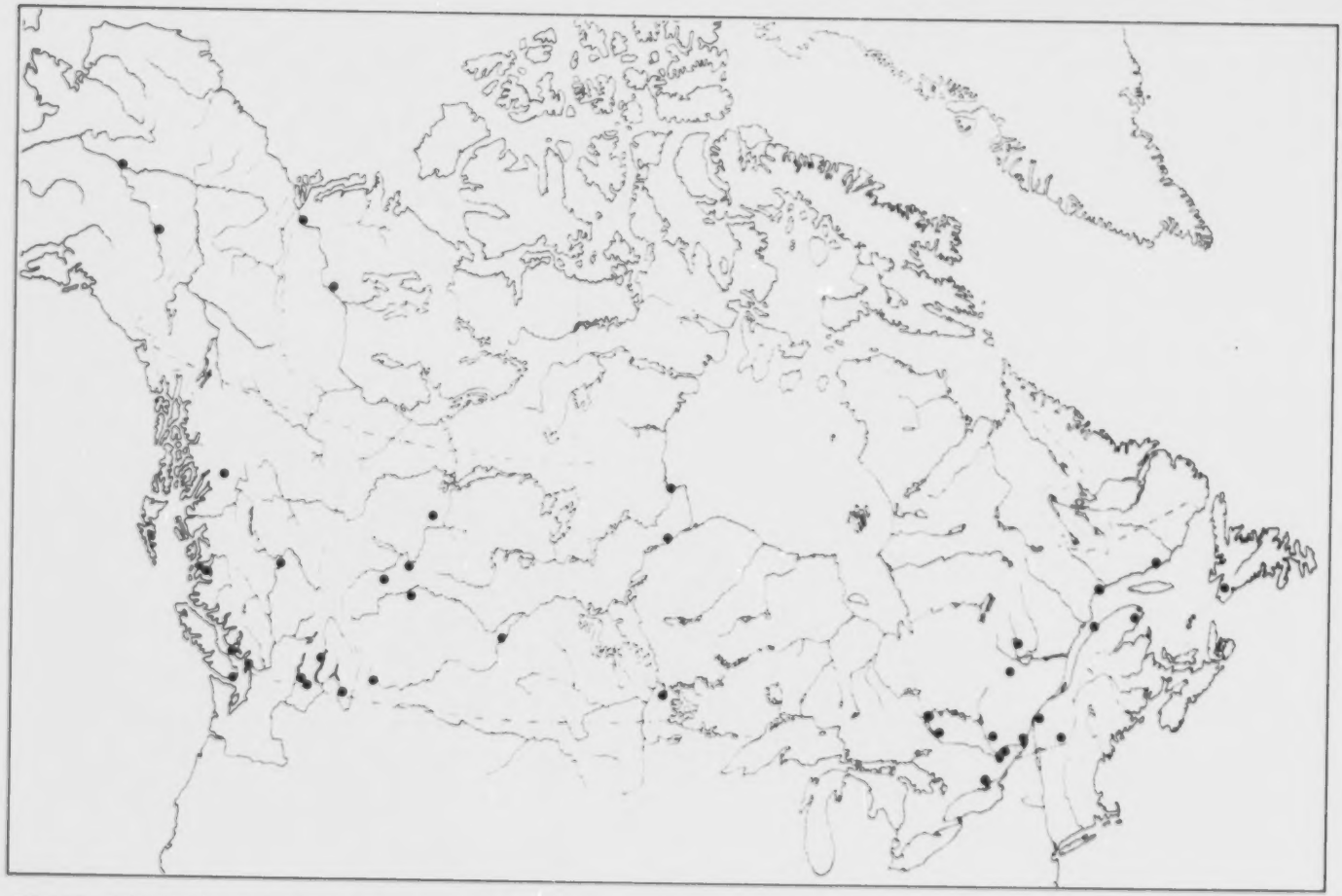
Pronotum at middle a little shorter than head; lateral margin serrulate and distinctly sinuate in anterior two-thirds, and anterolateral angles robust and rectangularly produced; posterolateral angles broadly rounded. Upper surface of pronotum with median carinae almost parallel-sided; paramedian carinae parallel with median carinae; lateral carinae obliterated.

Hemelytra covering entire body in male and not reaching tip of abdomen in female. Abdomen slightly exposed outside hemelytra in female. Female 8th abdominal tergite and connexival lobes as shown in Fig. 11.

Length of body: 4.0–4.2 mm in male, and 4.8–5.0 mm in female.

Distribution (Map 14): Alberta, Manitoba, Yukon Territory, Northwest Territories, Michigan, New York, and District of Columbia.

Associated plant: *Pinus contorta murrayana.*



Map 15. Distribution of *Aradus abbas* Bergroth in Canada.

Aradus (Aradus) abbas Bergroth

(Pl. 10*C*, *D*, Fig. 11)

Aradus abbas Bergroth, 1889, p. clxxx.

Color: Predominantly black or dark brown. Apical area of 3rd antennal segment and apical one-third to one-half of 2nd antennal segment pale yellow. Posterolateral angles of connexival segments white.

Structure: Head with median process not quite reaching basal one-quarter of 2nd antennal segment. Antennae slender; relative lengths of antennal segments: 2.3:10.0:5.0:4.8. Postocular tubercle absent. Rostrum reaching middle of mesosternum.

Pronotum at middle as long as head. Anterior lateral margin of pronotum slightly sinuate, serrulate, and with few spines at its anterior end. Upper surface of pronotum with median, paramedian, and lateral carinae almost parallel-sided.

Scutellum elongate subtriangular in shape; lateral margin feebly rounded in anterior one-third; upper surface transversely rugose and with a median discoidal elevation.

Hemelytra reaching or almost reaching posterior end of body in both sexes.

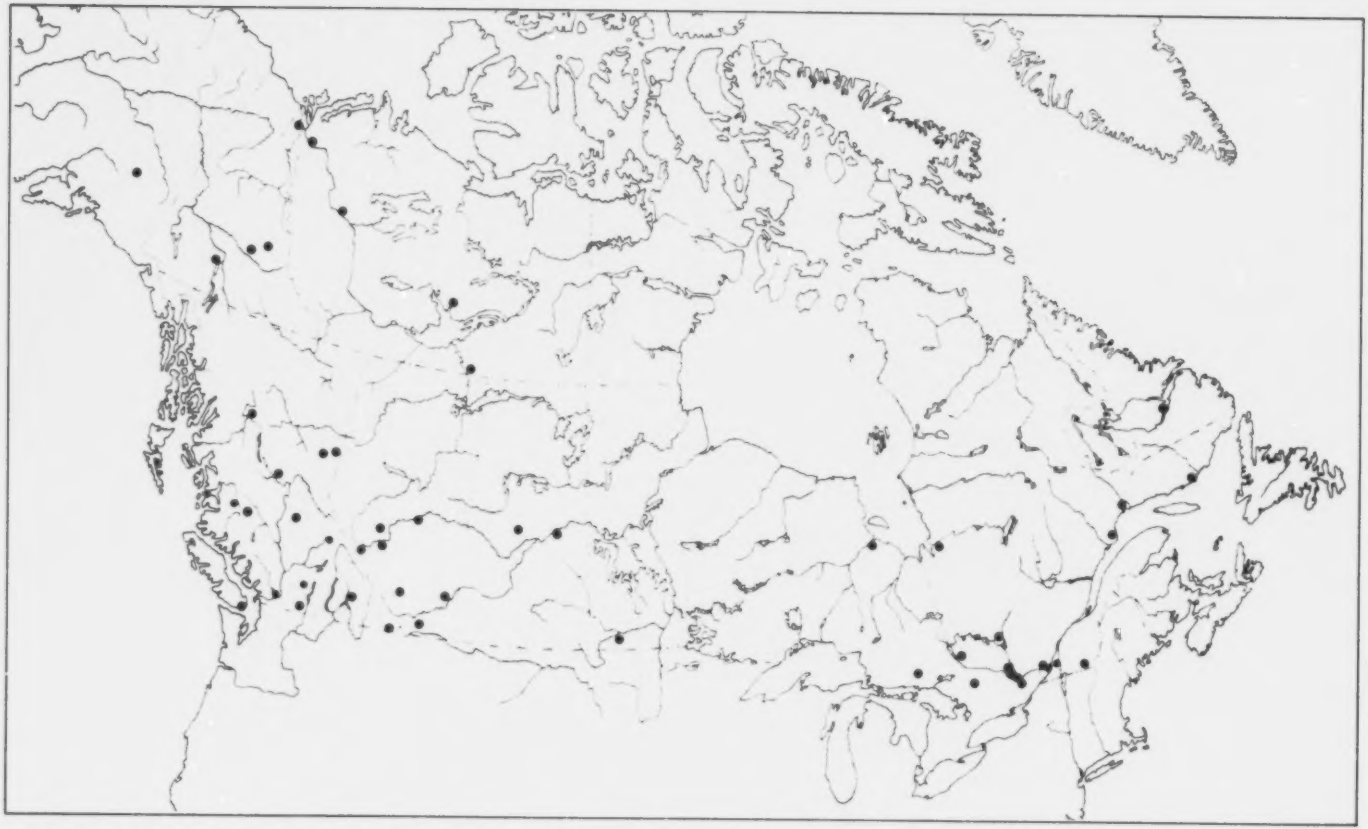
Abdomen wider than hemelytra at base (23:21 in male, 23.5:19.5 in female), and almost covered by hemelytra in male. Female 8th abdominal tergite and connexival lobes as shown in Fig. 11.

Length of body: 4.5–5.0 mm in male, and 5.0–5.7 mm in female.

Distribution (Map 15): This species has been found in all provinces of Canada except Nova Scotia, New Brunswick, Prince Edward Island, and Yukon Territory. This species is also known to occur in many states in the USA including Alaska.

Associated plants: *Pinus ponderosa*, *Pinus silvestris*, and *Taxodium* sp.

Remarks: This species is distinguishable from *A. lugubris* and *A. uniannulatus* by the more slender antennae and femora, the presence of spines on anterolateral angle of pronotum, and the shape of the connexival lobes of the female.



Map 16. Distribution of *Aradus lugubris* Fallén in Canada.

Aradus (Aradus) lugubris Fallén

(Pl. 10*E*, *F*, Fig. 11)

Aradus lugubris Fallén, 1807, p. 34.

Color: Black, often with brownish tinge in general coloration. Apical area of 3rd antennal segment pale yellow or white in some individuals. Apical area of each connexival segment with white band of varying degrees of development along posterior margin. Membrane whitish hyaline, with brownish maculations.

Structure: Head with median process reaching at least basal one-quarter of 2nd segment. Antennae rather robust; relative lengths of antennal segments: 2.2:8.5:4.5:4.0. Postocular tubercles absent. Rostrum usually reaching middle of mesosternum.

Pronotum with lateral margin serrulate and without conspicuous spine, slightly sinuate behind obtusely produced anterolateral angle. Upper surface of pronotum with median carinae slightly convergent in anterior one-third; paramedian carinae almost parallel-sided, reaching obscure transverse depression before middle; lateral carinae short and obscure.

Scutellum elongate subtriangular in shape, with an obtusely rounded apex; lateral margins parallel-sided for a short length at base; upper surface transversely rugose, with a discoidal elevation.

Hemelytra completely covering abdomen in male and often reaching apex of 8th abdominal tergite in female.

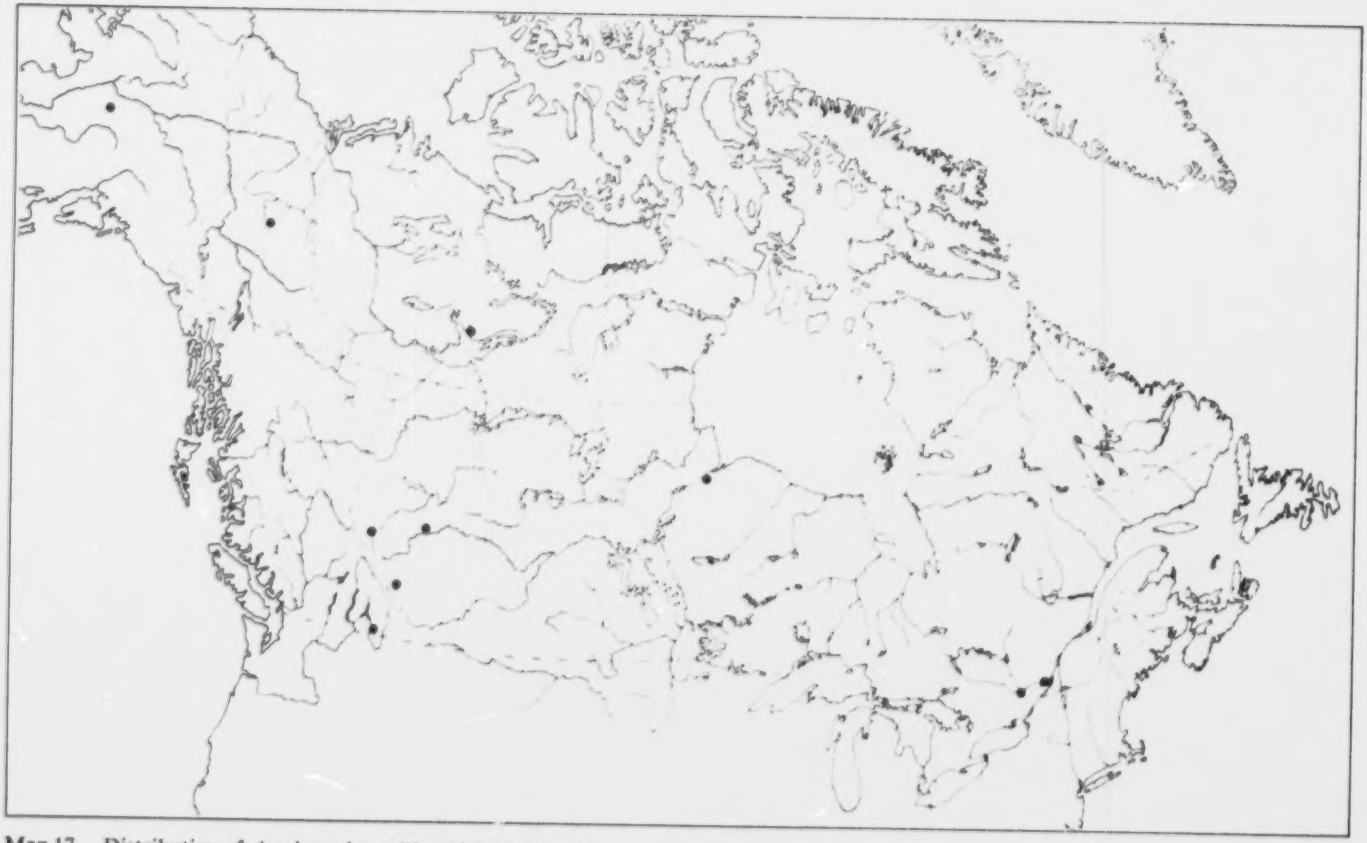
Abdomen in female wider than hemelytra at base (26:22). Female 8th abdominal tergite and connexival lobes as shown in Fig. 11.

Length of body: 4.7–5.0 mm in male, and 4.9–5.6 mm in female.

Distribution (Map 16): This species is a truly holarctic species, common in the New World as well as in the Old. In Canada this species has been collected in Quebec, Ontario, Newfoundland, Alberta, Saskatchewan, Nova Scotia, Manitoba, British Columbia, Yukon Territory, and Northwest Territories. The species is also known to occur in many states of the USA including Alaska.

Associated plants: *Pinus ponderosa*, *Pinus silvestris*, *Picea engelmanni*, *Picea excelsa*, and *Juniperus communis*.

Remarks: *Aradus lugubris* var. *nigricornis* Reuter refers to the individuals with an entirely black 3rd antennal segment. Such individuals occur apparently as commonly as individuals with an apically white or pale yellow 3rd antennal segment.



Map 17. Distribution of *Aradus tuberculifer* Kirby in Canada.

Aradus (Aradus) tuberculifer Kirby

(Pl. 11*C, D*, Fig. 12)

Aradus tuberculifer: Kirby, 1837, p. 278.
Aradus caliginosus: Walker, 1873, p. 36.
Aradus tuberculifer: Kirby, 1878, p. 213.
Aradus tuberculifer: Bergroth, 1913, p. 3.

Color: Predominantly black dorsally and ventrally. Basal half of 2nd antennal segment dark yellow to yellowish brown; posterior margins of connexival segments pale brown.

Structure: Head with narrow median process reaching basal one-fifth of 2nd antennal segment. Relative lengths of antennal segments: 3.0:12.2: 6.2:5.0; 2nd segment slender in basal half. Postocular lateral margin without tubercles. Rostrum extending slightly beyond posterior margin of prosternum.

Pronotum with anterior lateral margin sinuate and finely denticulated, ending anteriorly in an obtuse production behind the eye. Upper surface of pronotum with median carinae parallel-sided in anterior half, and somewhat bulged in posterior half; paramedian carinae extending slightly beyond middle of pronotum and parallel-sided; lateral carinae slightly divergent anteriorly; median transverse depression indistinct.

Scutellum with lateral margins well carinated; parallel-sided in anterior half or third, then narrowed posteriorly; apex of scutellum narrowly rounded; upper surface with a low median elevation.

Hemelytra almost reaching apex of abdomen in male, not quite reaching posterior margin of 8th abdominal tergite in female.

Abdomen much wider in female than in male. 6th connexival segment feebly produced at posterolateral angle. Line separating connexival lobes from 8th abdominal tergite often indistinct or absent (Fig. 12).

Length of body: 6.0–6.3 mm in male, and 7.0–7.3 mm in female.

Distribution (Map 17): Quebec, Ontario, Manitoba, Yukon Territory, Northwest Territories, Alberta, British Columbia, Maine, New York, Michigan, Minnesota, Alaska, Colorado, and California.

Remarks: This species is closely related to *A. funestus* Bergroth, from which, however, the species is distinguishable by the less bulged posterior half of the median carinae of the pronotum and by the different shapes of the scutellum and the connexival lobes.

Aradus (Aradus) parshleyi Van Duzee

(Pl. 11*A*, *B*, Fig. 12)

Aradus parshleyi Van Duzee, 1920, p. 336.

Distribution: British Columbia (Vernon), Northwest Territories (Resolution Island), and California.

Remarks: Structurally this species is difficult to distinguish from *A. tuberculifer*, and may well be a synonym of the latter. The specimens upon which this species were described or recorded were probably the newly emerged adults of *A. tuberculifer* Kirby. For the provisional separation of the two species, see the key.

Aradus (Aradus) funestus Bergroth

(Pl. 11*E*, *F*, Fig. 12)

Aradus funestus Bergroth, 1913, p. 4.

Color: Predominantly black. Hemelytra dark brown and paler at base. Posterior margins of connexival segments pale yellow. Apices of femora usually paler.

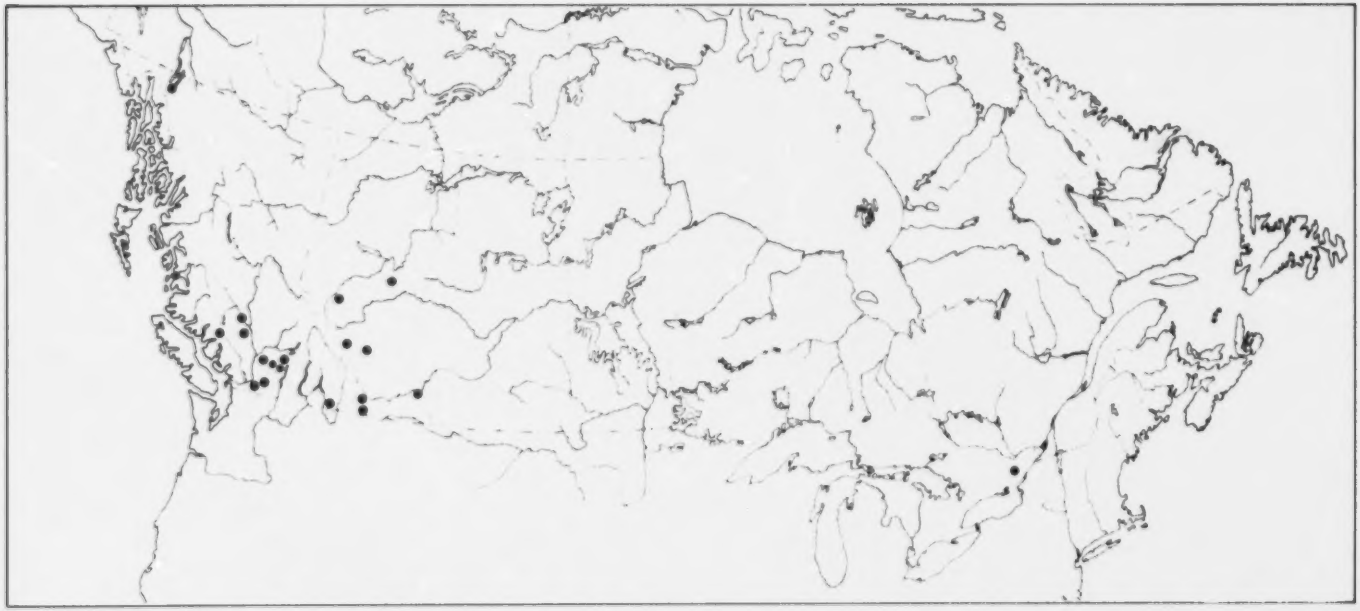
Structure: Head with median process reaching basal one-fifth of 2nd antennal segment. Relative lengths of antennal segments: 3:12:5:5. Postocular lateral margin without conspicuous spine or tubercle. Rostrum reaching slightly beyond posterior border of prosternum.

Pronotum with a robust anterolateral production on each side; lateral margin sinuate in anterior half, then broadly rounded posteriorly. Upper surface of pronotum with a distinct median transverse depression; median carinae bulged posteriorly, then strongly convergent above transverse depression, paramedian carinae parallel-sided; lateral carinae straight.

Scutellum broad; well-carinated lateral margins parallel-sided in anterior two-thirds, then strongly sinuate posteriorly, ending in narrow apex. Upper surface of scutellum with a low median elevation, and transversely rugose in posterior half.

Hemelytra at base definitely wider than pronotum at middle (33:25); their apices reaching tip of abdomen in male, and not quite reaching tip of abdomen in female.

Abdomen in male almost covered laterally by hemelytra, and posterolateral angle of 7th connexival segment clearly produced. Abdomen in female oval and clearly exposed outside hemelytra. Female 8th abdominal tergite and connexival lobes as shown in Fig. 12.



Map 18. Distribution of *Aradus funestus* Bergroth in Canada.

Length of body: 6.2–6.6 mm in male, and 6.9–7.5 mm in female.

Distribution (Map 18): Ontario, Alberta, British Columbia, Washington, Montana, Alaska, Idaho, Nevada, Arizona, Utah, California, Wyoming, and Colorado. Quebec was recorded without exact locality by Van Duzee (1917*b*) (not on map).

Associated plants: *Pseudotsuga taxifolia* and *Abies concolor*.

Remarks: The characteristic shapes of the scutellum and pronotal median carinae provide good diagnostic characters of this species.

Aradus (Aradus) falléni Stål

(Pl. 12*A*, *B*, Fig. 12)

Aradus falléni Stål, 1860, p. 68.

Color: Predominantly black. Antennae pale yellow except 1st segment and base of 2nd segment, which are darker. Cells of corium and membrane hyaline white. Posterior margins of connexival segments yellowish white.

Structure: Median process reaching basal one-third of 2nd antennal segment. Relative lengths of relatively short antennal segments: 1.5:6.0:3.1:3.0. Rostrum short, reaching or extending slightly beyond posterior margin of prosternum. Postocular lateral margin sinuate.

Pronotum with lateral margin slightly sinuate in anterior one-third, and without conspicuous denticles. Upper surface of pronotum with three pairs of carinae almost parallel-sided; paramedian carinae slightly convergent anteriorly, reaching obscure transverse depression before middle, lateral carinae parallel to paramedian carinae.

Scutellum elongate subtriangular in shape; lateral margin carinate and vertically erect; upper surface with a low median discoidal elevation, and posterior half of upper surface transversely rugose.

Hemelytra almost reaching posterior end of body in male and extending onto 8th abdominal tergite in female.

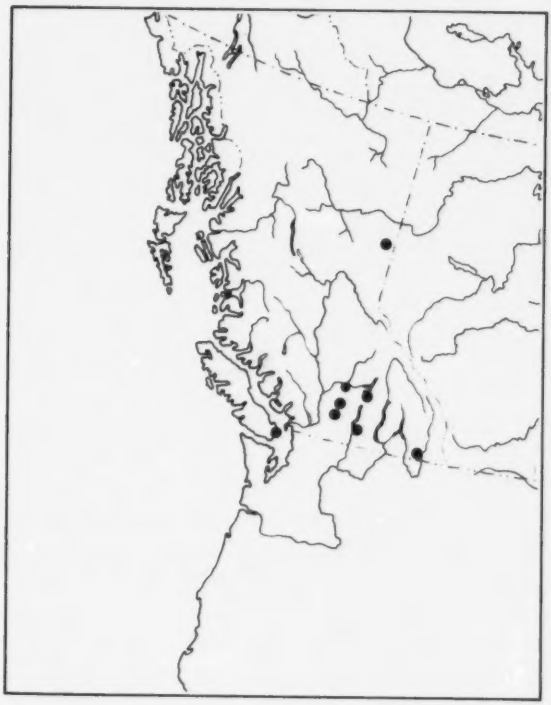
Abdomen about as wide as hemelytra at base in male, wider than hemelytra in female (38:30). Female 8th abdominal tergite and connexival lobes as shown in Fig. 12.

Length of body: 4.2–4.4 mm in male, and 4.6–4.8 mm in female.

Distribution: British Columbia (Revelstoke, Vancouver, and Victoria), many states of the USA, and Latin America.

Associated plant: *Pinus jeffreyi*.

Remarks: This species can be distinguished from the related species *A. lugubris*, *A. uniannulatus*, and *A. abbas* by different proportions and color of antennal segments.



Map 19. Distribution of *Aradus debilis* Uhler in Canada.

Aradus (Aradus) debilis Uhler

(Pl. 12*C*, *D*, Fig. 13)

Aradus debilis Uhler, 1876, p. 322.

Color: Predominantly yellowish brown to fuscous. 3rd antennal segment pale yellow except fuscous base. 4th antennal segment fuscous except apex, which is white pubescent. Hemelytra predominantly fuscous; veins often reddish. Connexival segments fuscous along anterior lateral margins.

Structure: Head with median process extending beyond basal one-quarter of 2nd antennal segment. Relative lengths of antennal segments: 3.3:23.0:8.0:7.8; 2nd segment longer than head. Upper surface of head

coated with small, whitish granules, especially mesally. Postocular lateral margins subrectangularly produced. Rostrum extending slightly beyond posterior border of mesosternum.

Pronotum with anterolateral half lobately reflected and with paired conspicuous calli; its lateral margin with several acute denticles. Rest of pronotum distinctly elevated and marked anteriorly by distinct transverse depression. Median carinae slightly convergent anteriorly; paramedian carinae almost parallel-sided; lateral carinae distinct, reaching median transverse depression.

Scutellum relatively broad; its lateral margins parallel-sided in anterior half, then converging posteriorly, ending in obtusely rounded tip; upper surface with a mass of pale tubercles along anterior lateral margin on each side, and shallowly depressed in posterior half.

Hemelytra reaching middle of 7th abdominal segment in female. Abdomen strongly narrowed posteriorly in female. Female 8th abdominal tergite and connexival lobes as shown in Fig. 13.

Length of body: 8.9–9.6 mm in male, and 10.2–11.0 mm in female.

Distribution (Map 19): British Columbia, California, Washington, Idaho, Colorado, New York, Montana, and Massachusetts (?).

Associated plants: *Pinus ponderosa, Pinus jeffreyi, Pinus contorta, Abies grandis, Abies magnifica, Abies concolor, Cryptoporus* fungus on *Pinus*, and *Polyporus volvatus* on *Pinus lambertiana.*

Remarks: This large, rather rare species can be easily identified by the color and structure of antennae, pronotal structures, and other characters.

Aradus (Aradus) similis Say

(Pl. 12*E, F*, Fig. 13)

Aradus similis Say, 1832, p. 351.
Aradus fascicornis Walker, 1873, p. 36.
Aradus centriguttatus Bergroth, 1887, p. 246.

Color: Predominantly dark brown. 3rd antennal segment pale yellow except fuscous base. Posterolateral angles of connexival segments pale yellow.

Structure: Head with median process thick, slightly extending beyond basal one-third of 2nd antennal segment. Relative lengths of antennal segments: 2.8:11.0:5.2:5.0. Postocular lateral margin with a small prominent tubercle. Rostrum reaching or extending slightly beyond posterior margin of prosternum.

Pronotum widest at middle, and its lateral margin armed with distinct spines in anterior half. Upper surface of pronotum with median carinae convergent on median transverse depression; paramedian carinae convergent beyond median transverse depression; lateral carinae distinct.

Scutellum with lateral margins slightly sinuate in posterior one-third; upper surface without distinct elevation.

Hemelytra almost reaching posterior end of abdomen in male, short and not reaching or almost reaching posterior margin of 7th abdominal tergite in female.

Abdomen with connexival segments feebly crenulate in female. Female 8th abdominal tergite and connexival lobes as shown in Fig. 13.

Length of body: 5.7 mm in male, and 6.8–7.3 mm in female.

Distribution: Ontario (Rainy River district, New Glasgow, and Carado County), Quebec (Kazabazua), Nova Scotia (no exact locality was given by Parshley 1921), and many states of the USA.

Associated plants: *Polyporus* fungus on *Betula, Ulmus, Acer, Quercus,* and *Fraxinus.*

Remarks: In the relatively thick median process of the head and the relatively short antennae this species resembles *A. parvicornis.* However, in this species the median process of the head does not reach the middle of the 2nd antennal segment, and the antenna is thicker and longer than that in *A. parvicornis.*

Aradus (Aradus) persimilis Van Duzee

(Pl. 13*A, B,* Fig. 13)

Aradus persimilis Van Duzee, 1916, p. 232.

Color: Predominantly pale yellowish brown. Antennae reddish brown; 4th antennal segment darker. Connexivum variegated yellow and red or reddish brown. Predominantly dark brown in one specimen examined.

Structure: Head with median process robust and broadly rounded apically, reaching basal one-quarter of 2nd antennal segment. Antennae slender; relative lengths of antennal segments: 3.0:12.5:6.0:6.0. Postocular lateral margin with a prominent tubercle. Rostrum clearly extending beyond posterior border of prosternum.

Pronotum widest behind middle; lateral margin with conspicuous spines in anterior two-thirds and not reflected along lateral margin. Upper surface of pronotum with well-marked median transverse depression; anterior half

of pronotum strongly elevated and not reflected laterally; median carinae slightly convergent anteriorly; paramedian carinae almost straight and convergent; lateral carinae distinct, not reaching median transverse depression.

Scutellum with well-carinated lateral margins parallel-sided in anterior one-third, then convergent posteriorly; upper surface finely granulated, slightly elevated anteriorly and transversely rugose posteriorly.

Hemelytra almost reaching apex of abdomen in male, and almost reaching posterior margin of 7th tergite in female.

Abdomen with connexival segments feebly crenulate, more so in male than in female. Female 8th abdominal tergite and connexival lobes as shown in Fig. 13.

Length of body: 5.8–6.2 mm in male, and 7.1–7.6 mm in female.

Distribution: British Columbia (Sooke, Terrace, and Garibaldi Park near Squamish), Alberta (Waterton Lakes National Park and Edmonton), Washington, Montana, Colorado, and California.

Associated plants: *Pseudotsuga menziesii* (Douglas spruce of Parshley 1921), and *Polyporus* fungus on *Abies magnifica*.

Remarks: The pronotal structures are good diagnostic characters of this species.

Aradus (Aradus) shermani Heidemann

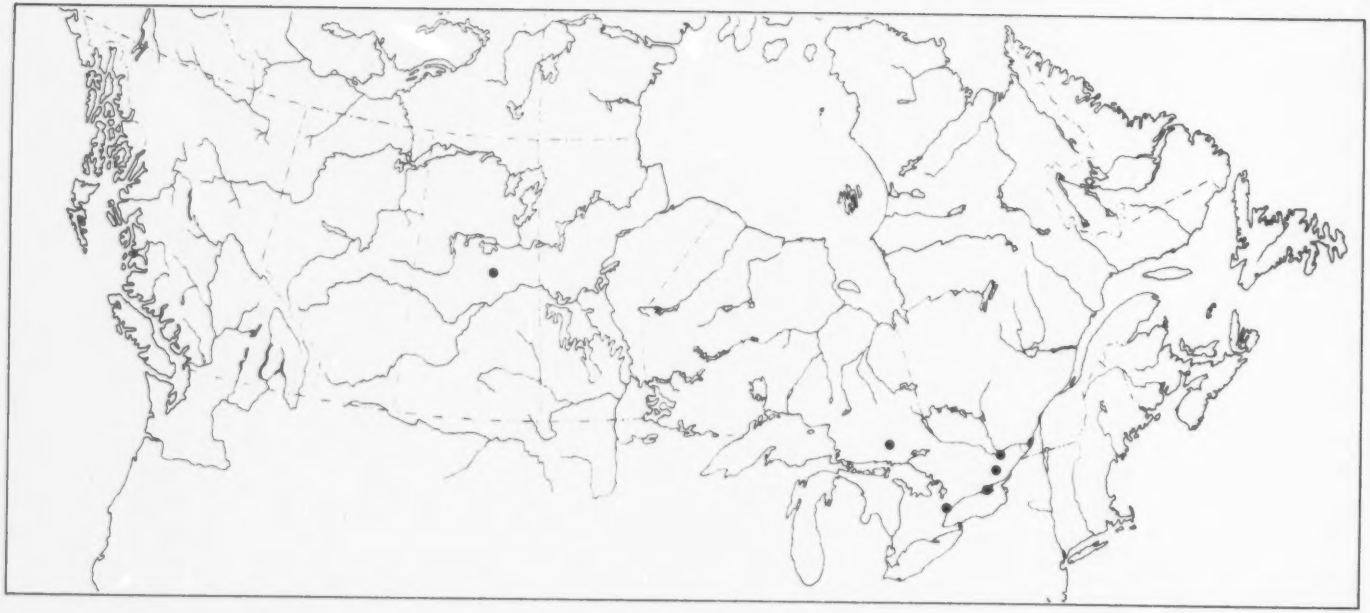
(Pl. 13*C*, *D*, Fig. 14)

Aradus shermani Heidemann, 1907, p. 68.

Color: Black or almost black in general coloration. Head including all antennal segments, pronotum, and scutellum black. Connexivum dark reddish brown to black, with a pale brown spot at posterolateral angle of each segment. Under surface of body almost black.

Structure: Head a little longer than wide. Median process not reaching basal one-third of 2nd antennal segment. Relative lengths of antennal segments: 3.0:13.5:6.0:5.0. Postocular lateral margin with a distinct tubercle. Rostrum reaching or extending slightly beyond posterior margin of prosternum.

Pronotum with lateral margin rounded and widest at middle, and with some distinct spines in anterior half. Upper surface of pronotum with median carinae slightly convergent at middle; paramedian carinae slightly convergent anteriorly; lateral carinae reaching shallow transverse depression.



Map 20. Distribution of *Aradus shermani* Heidemann in Canada.

Scutellum relatively broad and short. Anterior one-third of lateral margins almost parallel-sided, then narrowed posteriorly; upper surface with an obscure median elevation and transversely rugose in posterior half.

Hemelytra reaching posterior end of body in male, much shorter and not reaching posterior margin of 7th abdominal tergite in female.

Abdomen with connexival segments slightly crenulate. Female 8th abdominal tergite and connexival lobes as shown in Fig. 14.

Length of body: 6.7–7.0 mm in male, and 7.7 mm in female.

Distribution (Map 20): Ontario, Saskatchewan, Maine, North Carolina, Georgia, and New Jersey.

Remarks: Black general coloration and relatively large size are diagnostic characters of this species.

Aradus (Aradus) vadosus Van Duzee

(Pl. 13*E*, *F*, Fig. 14)

Aradus vadosus Van Duzee, 1920, p. 334.

Color: Predominantly pale yellow, mottled with dark spots and areas. 4th antennal segment black except apex, which is white pubescent. Pronotum dark brown except yellowish lateral areas. Dark spots present on anterolateral angles of connexival segments.

Structure: Head with median process reaching basal one-third of 2nd antennal segment. Upper surface of head with pale tubercles in posterior half. Relative lengths of antennal segments: 3.0:16.5:6.5:7.0. Postocular lateral margin of head with an obtuse tubercle. Rostrum reaching or almost reaching posterior margin of mesosternum.

Pronotum having lateral margin with several conspicuous denticles in anterior half. Upper surface with median carinae slightly convergent toward middle; paramedian carinae convergent anteriorly; lateral carinae short, not reaching well-marked median transverse depression.

Scutellum with lateral margins almost parallel-sided in anterior one-third, then converging posteriorly; upper surface with 3 low longitudinal ridges, and transversely rugose in posterior half.

Hemelytra reaching posterior margin of 7th abdominal segment in female, and almost reaching tip of abdomen in male. Abdomen with connexival segments not crenulate. Female 8th abdominal tergite and connexival lobes as shown in Fig. 14.

Length of body: 8.6 mm in male, and 9.3 mm in female.

Distribution: British Columbia (Nicola, Kamloops, and Vancouver Island) and Montana.

Remarks: This species somewhat resembles *A. debilis* from which, however, the species is easily distinguishable by the different proportional lengths of antennal segments and the different shape of the pronotum.

Aradus (Aradus) consors Parshley

(Pl. 14*A*, Fig. 14)

Aradus (*Aradus*) *consors* Parshley, 1921, p. 56.

Color: Predominantly grayish brown. Connexival segments darker along lateral margins, except their posterior ends, which are paler. Antennae light reddish brown; apices of 2nd and 3rd antennal segments paler. 4th antennal segment dark.

Structure: Head with median process reaching basal one-third of 2nd antennal segment. Relative lengths of antennal segments: 3.0:13.5:6.2:6.0. Postocular lateral margin with a distinct tubercular prominence. Rostrum clearly extending beyond posterior border of prosternum.

Pronotum widest at middle, distinctly denticulated on anterior half of lateral margin. Upper surface of pronotum with median carinae convergent anteriorly; paramedian carinae parallel with median carinae and reaching median transverse depression; lateral carinae indistinct.

Scutellum gently rounded on lateral margins; upper surface with a slight antemedian elevation.

Hemelytra at base broader than pronotum at middle, their apices extending beyond posterior border of 7th segment in female. Abdomen with connexival segments distinctly crenulate in female. Female 8th abdominal tergite and connexival lobes as shown in Fig. 14.

Length of body: 9.0 mm in female.

Distribution: Massachusetts (South Henshaw).

Remarks: This species is related to *A. proboscideus*, but is readily distinguishable by crenate connexival segments, the different shape of the connexival lobes, and the more strongly convergent pronotal median carinae. Known only from the type specimen.

Aradus (Aradus) medioximus Parshley

(Pl. 14*B*, Fig. 15)

Aradus (Aradus) medioximus Parshley, 1921, p. 58.

Color: Pale yellowish brown in general coloration. 3rd and 4th antennal segments darker. Apices of 2nd and 3rd segments pale yellow. Each connexival segment pale on posterolateral angle and along posterior margin.

Structure: Head with median process thick, its apex reaching basal one-third of 2nd antennal segment. Postocular lateral margin subrectangularly produced. Vertex with two rows of coarse tubercles. Relative lengths of antennal segments: 3.5:14.5:6.5:5.5. Rostrum reaching middle of mesosternum.

Pronotum with anterior half of lateral margin slightly sinuate and with several prominent spines, and posterolateral angles of pronotum broadly rounded. Anterior half of pronotum elevated and well defined by median transverse depression. Median carinae slightly convergent at middle on transverse depression; paramedian carinae parallel-sided and obscured beyond transverse depression; lateral carinae well marked and not reaching transverse depression.

Scutellum with lateral margins well carinated and dark, subparallel-sided in anterior one-third, then broadly rounded; upper surface with a distinct median longitudinal carinae in anterior half.

Hemelytra extending slightly beyond anterior margin of 7th tergite in female.

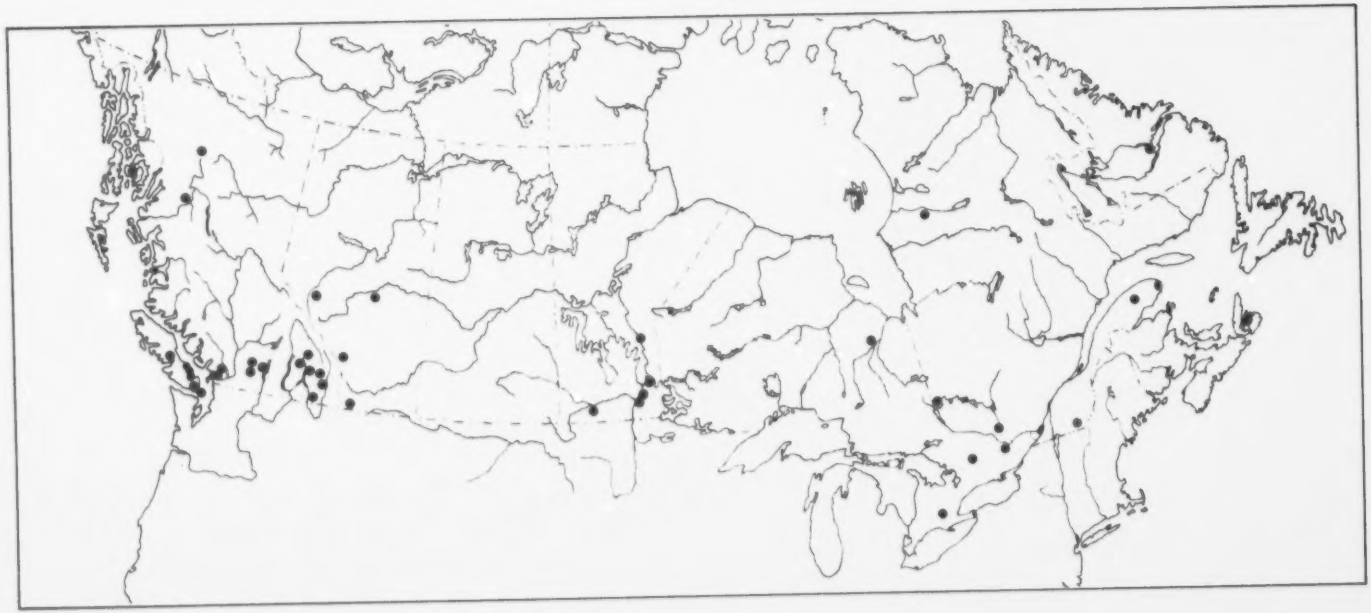
Abdomen a little wider than hemelytra at base in female. Posterolateral angles of connexival segments not crenulate. Female 8th abdominal tergite and connexival lobes as shown in Fig. 15.

Length of body: 7.3 mm in male, and 8.1 mm in female.

Distribution: British Columbia (Vancouver Island), Oregon, and California.

Associated plants: *Polyporus* fungus on *Abies concolor*, and *Pinus ponderosa*.

Remarks: This species resembles *A. persimilis* (Pl. 13*A*, *B*, Fig. 13), but differs in having a broader abdomen, the unusual shape of female 8th abdominal tergite and connexival lobes, and two rows of coarse granules on the vertex.



Map 21. Distribution of *Aradus proboscideus* Walker in Canada.

Aradus (Aradus) proboscideus Walker

(Pl. 14*C, D*, Fig. 15)

Aradus proboscideus Walker, 1873, p. 35.
Aradus luteolus Fyles, 1903, p. 75.
Aradus hubbardi Heidemann, 1904, p. 232.
Aradus taylori Van Duzee, 1920, p. 335.

Color: Dark brown to cinnamon brown in general coloration. Apical part of 3rd antennal segment, posterolateral angles of connexival segments, and hemelytra at base pale yellow. Membrane hyaline white.

Structure: Head with relatively thick median process almost reaching middle of 2nd antennal segment. Relative lengths of slender antennal segments: 3.0:14.2:6.5:6.5. Upper surface of head granulated and preocular spine distinct. Postocular lateral margin with a minute projection. Rostrum reaching middle of mesosternum.

Pronotum widest behind middle, and with distinct spines on anterior half of lateral margin. Upper surface of pronotum with median carinae slightly convergent at middle; paramedian carinae convergent, especially anteriorly; lateral carinae distinct but short.

Scutellum with lateral margins almost parallel-sided in anterior one-third, then convergent posteriorly; upper surface granulated and with a low median elevation.

Hemelytra completely covering genitalia in male, and reaching or not quite reaching posterior margin of 7th tergite in female.

Abdomen ovate, broader in female than in male. Posterolateral angles of connexival segments feebly crenulate in male. Female 8th abdominal tergite and connexival lobes as shown in Fig. 15.

Length of body: 5.7 mm in male, and 7.0–7.9 mm in female.

Distribution (Map 21): Nova Scotia, Quebec, Alberta, New Brunswick, Ontario, Manitoba, British Columbia, Alaska, and many states in the USA.

Associated plants: Fungus on *Picea, Pinus, Fomes penicola* fungus on *Abies magnifica, Abies concolor, Pinus ponderosa,* and *Pinus jeffreyi.*

Remarks: This species is distinguishable from the closely related species *A. serratus* and *A. basalis* with the use of the key.

Aradus (Aradus) basalis Parshley

(Pl. 14*E*, Fig. 15)

Aradus (*Aradus*) *basalis* Parshley, 1921, p. 54.

Color: Predominantly dark reddish brown. 2nd and 3rd antennal segments pale at apices. Dull yellow along posterolateral margin of pronotum and in anterior half of corium. Connexival segments narrowly dull yellow along posterior margins.

Structure: Head with upper surface evenly clothed with fine pale granules. Median process reaching basal one-quarter of 2nd antennal segment. Relative lengths of slender antennal segments: 3.0:16.5:7.5:6.5. Postocular lateral margins obtusely rounded immediately behind eyes. Rostrum clearly extending beyond posterior border of prosternum, but not reaching middle of mesosternum.

Pronotum with lateral margin broadly rounded and obscurely denticulated in anterior halves; widest at middle. Upper surface of pronotum with median carinae subparallel-sided; paramedian carinae parallel-sided, reaching median transverse depression; lateral carinae distinct.

Scutellum with lateral margins parallel-sided in anterior one-third, then straightly convergent posteriorly. Upper surface of scutellum with a round median elevation, and transversely rugose in posterior half.

Hemelytra extending slightly beyond posterior margin of 6th abdominal segment in female.

Abdomen in female oval, and posterolateral angles feebly crenulate. Female 8th abdominal tergite as shown in Fig. 15.

Length of body: 8.5 mm in female.

Distribution: New Hampshire and Maine.

Remarks: This species is closely allied to *A. serratus*, but is distinguishable by the relatively larger pronotum and the absence of distinct denticles on the anterior half of the pronotum.

Aradus (Aradus) serratus Usinger

(Pl. 14*F*, Fig. 15)

Aradus serratus Usinger, 1936, p. 496.

Color: Predominantly dark brown to almost black. Base of wings pale yellow. Posterolateral angles of connexival segments yellow.

Structure: Head with median process reaching basal two-fifths of 2nd antennal segment. Relative lengths of slender antennal segments: 3.5:13.5: 7.0:6.8. Postocular tubercles distinct. Rostrum extending slightly beyond posterior margin of prosternum.

Pronotum with lateral margin distinctly serrulate in anterior half, and widest at middle. Upper surface of pronotum with median carinae parallel-sided; paramedian carinae parallel to median carinae, extending slightly beyond median transverse impression; short lateral carinae slightly convergent anteriorly.

Scutellum with lateral margins subparallel-sided in anterior half, then converging posteriorly, ending in broadly rounded apex; upper surface of scutellum with a faint, median elevation and transversely rugose in posterior half.

Hemelytra reaching only to posterior margin of 6th segment in female.

Abdomen ovate in female; posterolateral angles of connexival segments feebly produced. Female 8th abdominal tergite and connexival lobes as shown in Fig. 15.

Length of body: 7.9–8.8 mm in female.

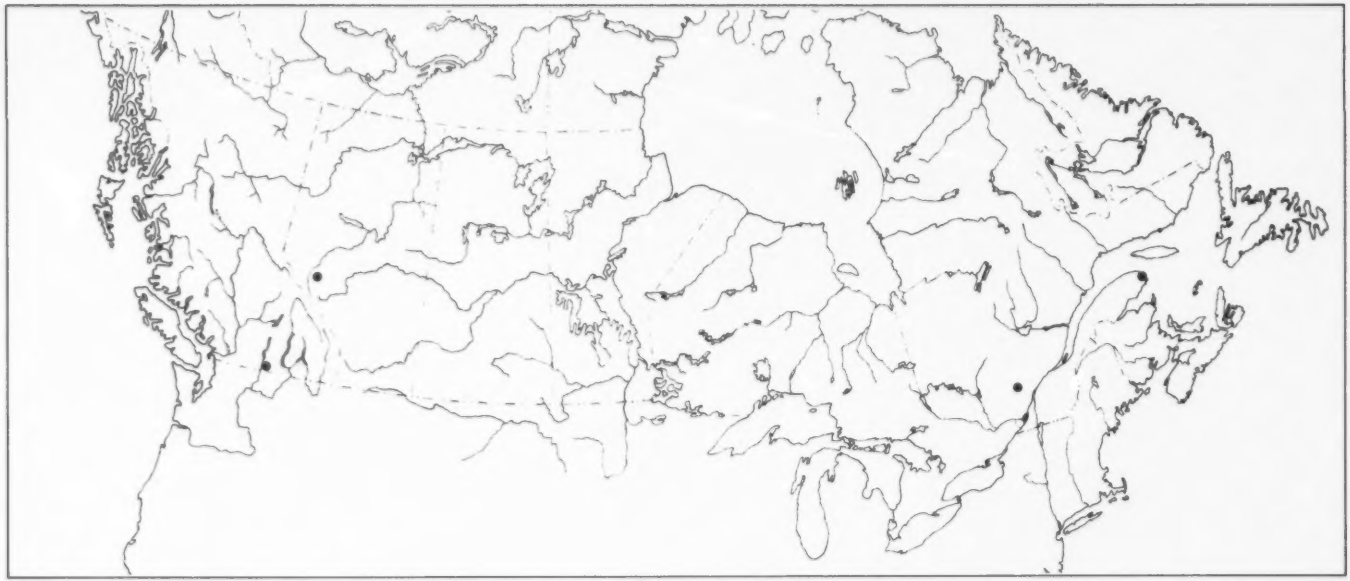
Distribution: This species has been known only from Alberta (Kananaskis, Mosimon, 24 km, or 15 miles, west of Sappello).

Remarks: To distinguish from *A. basalis*, see the key.

Key to the species of *Aneurus* Curtis (1825) in Canada

Median process of head extending beyond anterior end of 1st antennal segment (Pl. 15*A*, *B*). Length of body more than 4.5 mm .... ***Aneurus septentrionalis* Walker**

Median process of head not reaching apex of 1st antennal segment (Pl. 15*E*, *F*). Length of body less than 4.5 mm ..... ***Aneurus inconstans* Uhler**



Map 22. Distribution of *Aneurus septentrionalis* Walker in Canada.

Descriptions of species of *Aneurus* Curtis (1825)

Aneurus septentrionalis Walker

(Pl. 15*A–D*)

Aneurus septentrionalis: Walker, 1873, p. 30.
Aneurus septentrionalis: Bergroth, 1892, p. 337.
Aneurus septentrionalis: Van Duzee, 1912, p. 323.
Aneurus septentrionalis: Van Duzee, 1917*b*, p. 141.
Aneurus septentrionalis: Kormilev, 1968, p. 2.

Color: Unicolorous, pale reddish brown. Hemelytra hyaline.

Structure: Head with median process slightly constricted near apex; its apex extending beyond 1st antennal segment. Relative lengths of antennal segments: 3.3:4.2:5.3:7.5. Total length of antennae about as long as head and pronotum together at middle. Postocular spines reaching or extending slightly beyond lateral margins of eyes.

Pronotum at middle a little shorter than head, and as long as scutellum; its lateral margin clearly sinuate in anterior half; callosities in anterior half of pronotal surface obliterated.

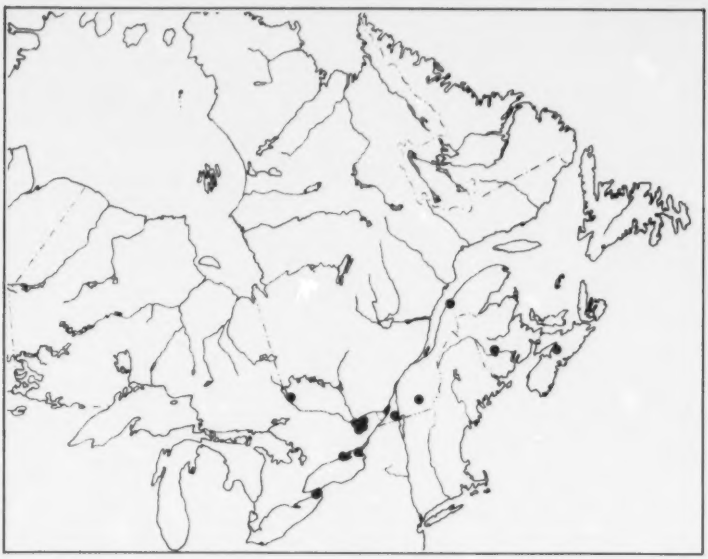
Scutellum with broadly rounded apical margin; its upper surface largely concentrically rugulose.

Hemelytra with basal sclerotized area not quite reaching middle of lateral margin of scutellum; apices of membranous part of hemelytra extending slightly beyond posterior margin of the fully developed 5th (actually, 6th) abdominal tergite.

Greatest width of abdomen 1.5 times that of pronotum (33:21.5) in female. All spiracles ventral, located at middle of each connexival segment, and near its inner margin in anterior segments. Male and female genital segments as shown in Pl. 15*C*, *D*.

Length of body: 4.6–4.8 mm in male, and 5.1–5.3 mm in female.

Distribution (Map 22): Nova Scotia and Ontario (recorded by Van Duzee, 1917*b*, without exact locality), Quebec, British Columbia, Alberta, New York, and New Jersey.



Map 23. Distribution of *Aneurus inconstans* Uhler in Canada.

Aneurus inconstans Uhler

(Pl. 15*E–H*)

Aneurus inconstans Uhler, 1871, p. 105.

Color: Dark reddish brown. Upper surface of head, pronotum, and membrane of hemelytra almost black.

Structure: Head with median process not reaching anterior end of 1st antennal segment. Relative lengths of antennal segments: 2.5:3.1:4.1:5.8. Total length of antennae shorter than head and pronotum together. Postocular spines obtuse and not reaching lateral margins of eyes.

Pronotum with anterolateral angle obtuse; lateral margin distinctly sinuate in anterior half, and parallel-sided in posterior half. Upper surface of pronotum with an obscure median transverse impression.

Scutellum with lateral margin distinctly carinated anteriorly; upper surface with a narrow median longitudinal elevation.

Hemelytra with basal sclerotized area extending beyond middle of lateral margin of scutellum. Apex of membrane extending slightly beyond posterior margin of fully developed 5th abdominal tergite.

Abdomen 1.5 times as wide as greatest width of pronotum (27:18.5). 6th abdominal spiracle lateral. Genital segments as shown in Pl. 15*G*, *H*.

Length of body: 4.0–4.2 mm in male, and 4.2–4.3 mm in female.

Distribution (Map 23): British Columbia, Quebec, Ontario, Nova Scotia, New Brunswick, New Hampshire, Massachusetts, New York, New Jersey, Pennsylvania, South Dakota, and Indiana.

Associated plant: *Abies lasiocarpa*.

Figures 1–15

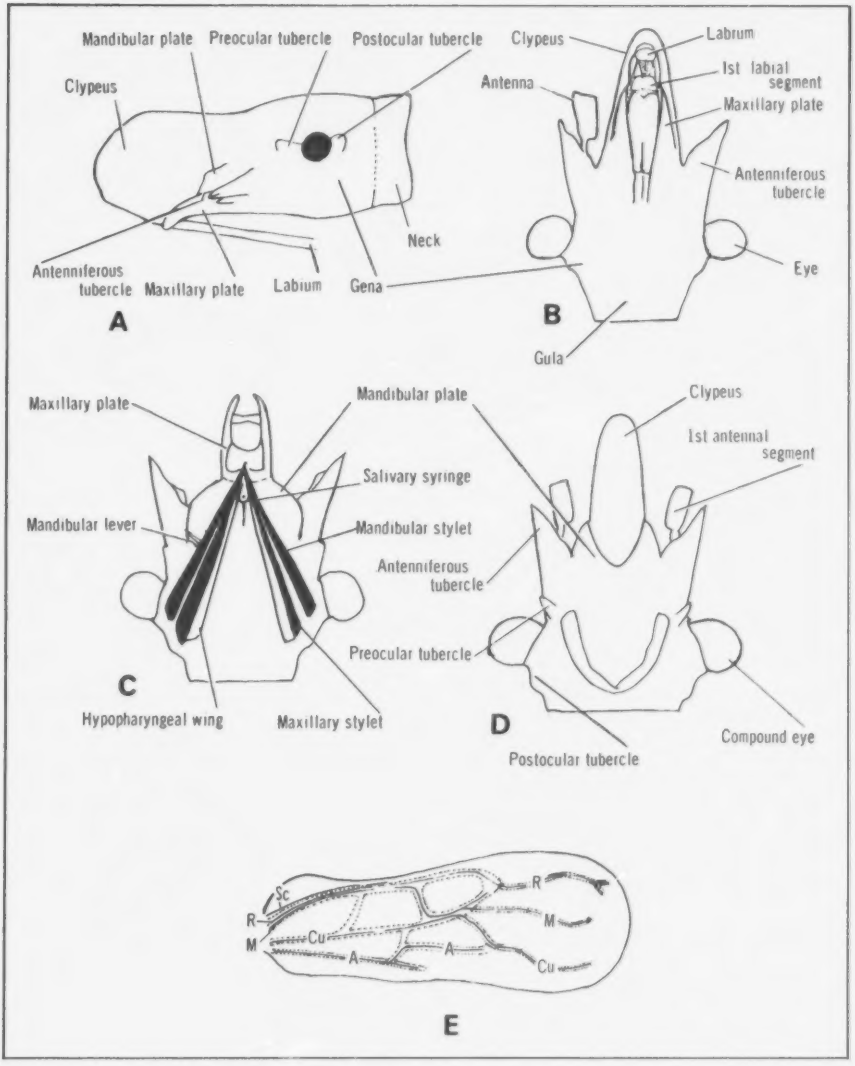


Fig. 1. *Aradus debilis* Uhler. Head: *A*, side view; *B*, ventral view; *C*, dorsal view of clypeus with upper surface removed; *D*, dorsal surface. *E*, Fore wing in *Aradus pannosus* Van Duzee: *Sc*, subcostal vein; *R*, radial vein; *M*, medial vein; *Cu*, cubital vein; *A*, anal vein. All figures from Usinger and Matsuda (1959).

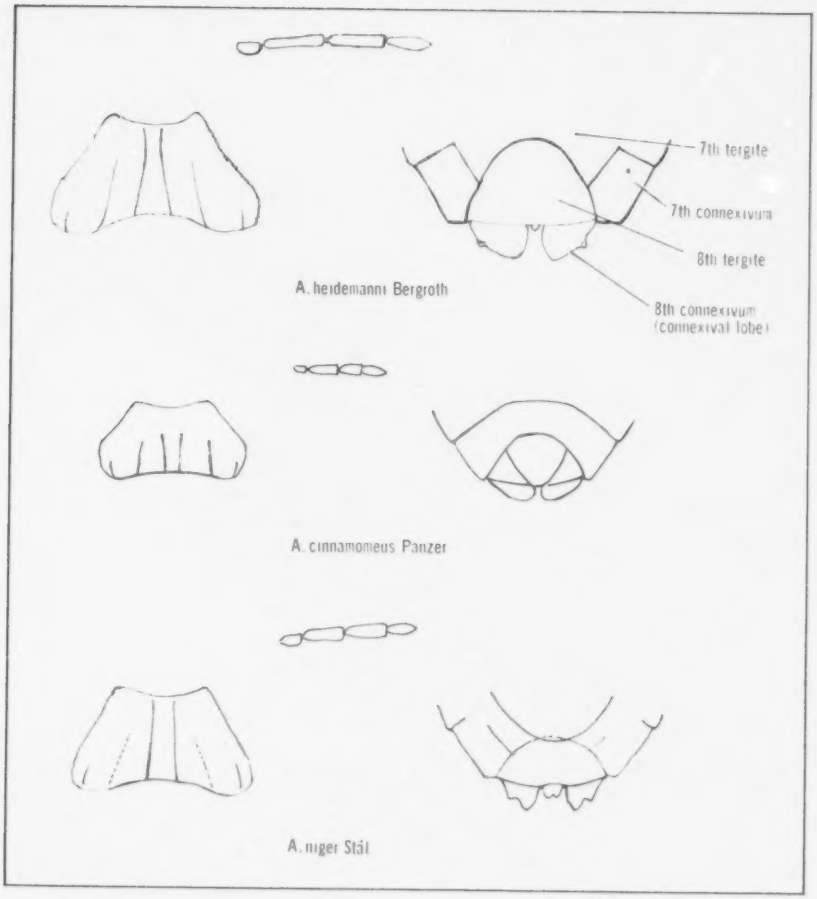


Fig. 2. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

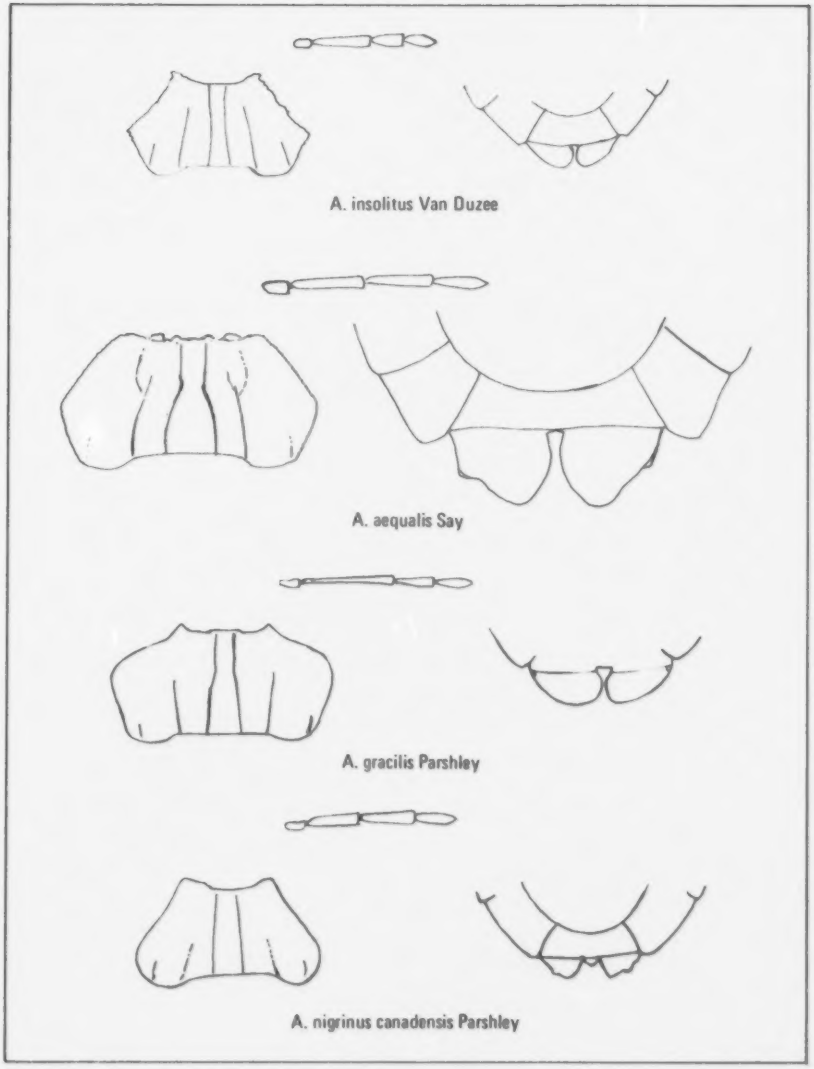


Fig. 3. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

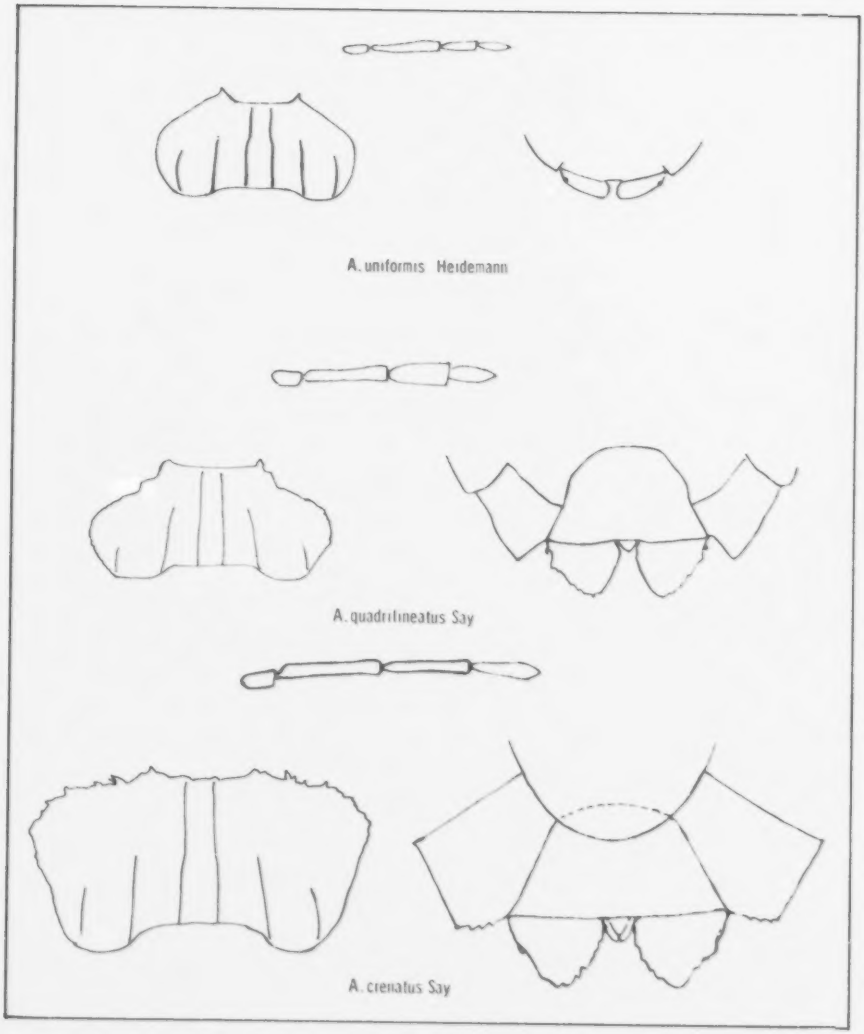


Fig. 4. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

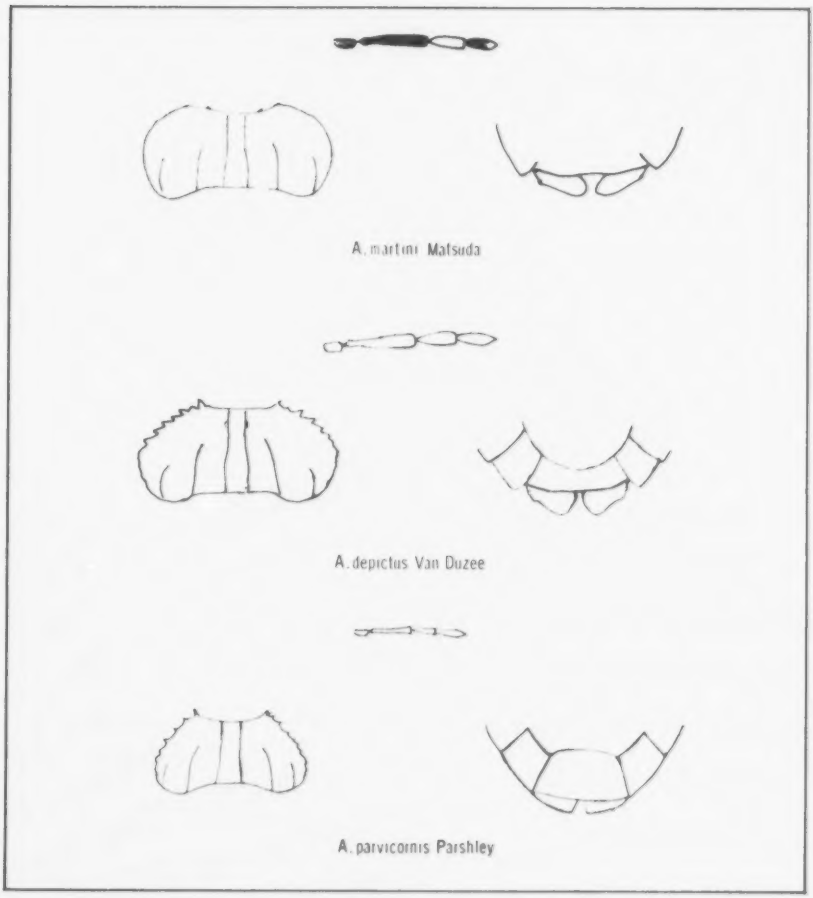


Fig. 5. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

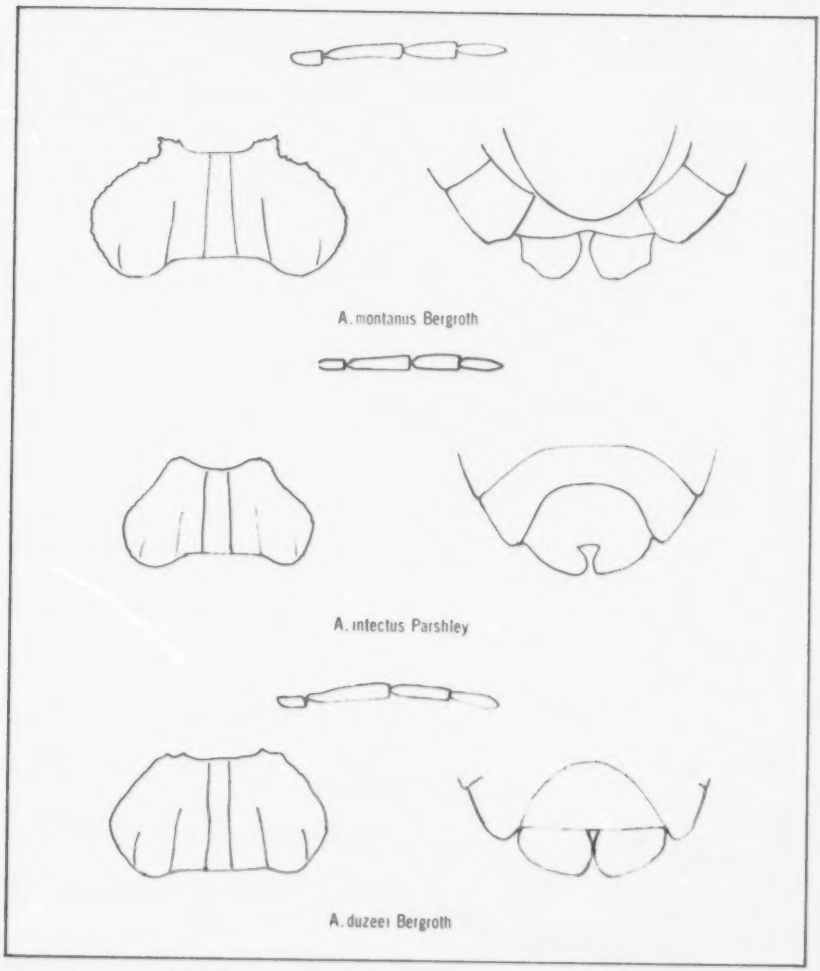


Fig. 6. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

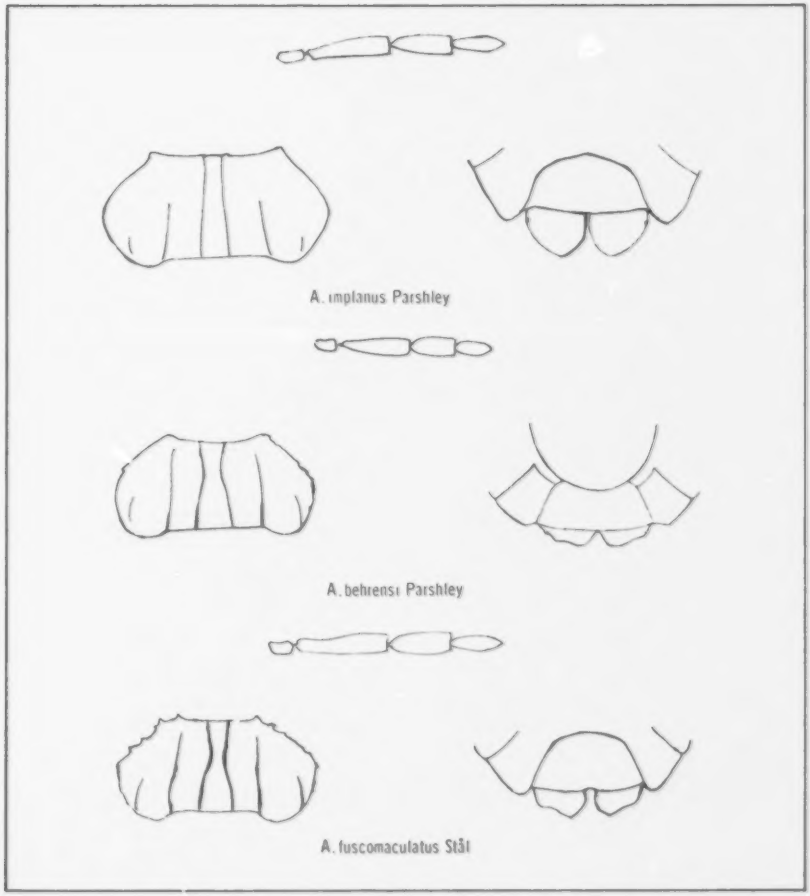


Fig. 7. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

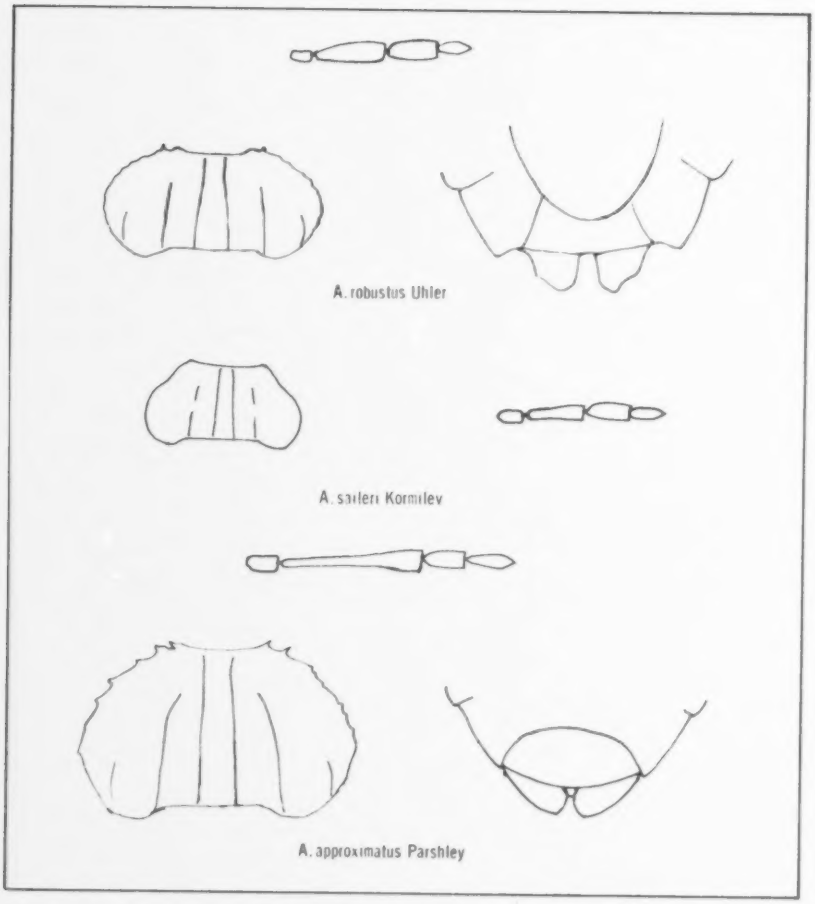


Fig. 8. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

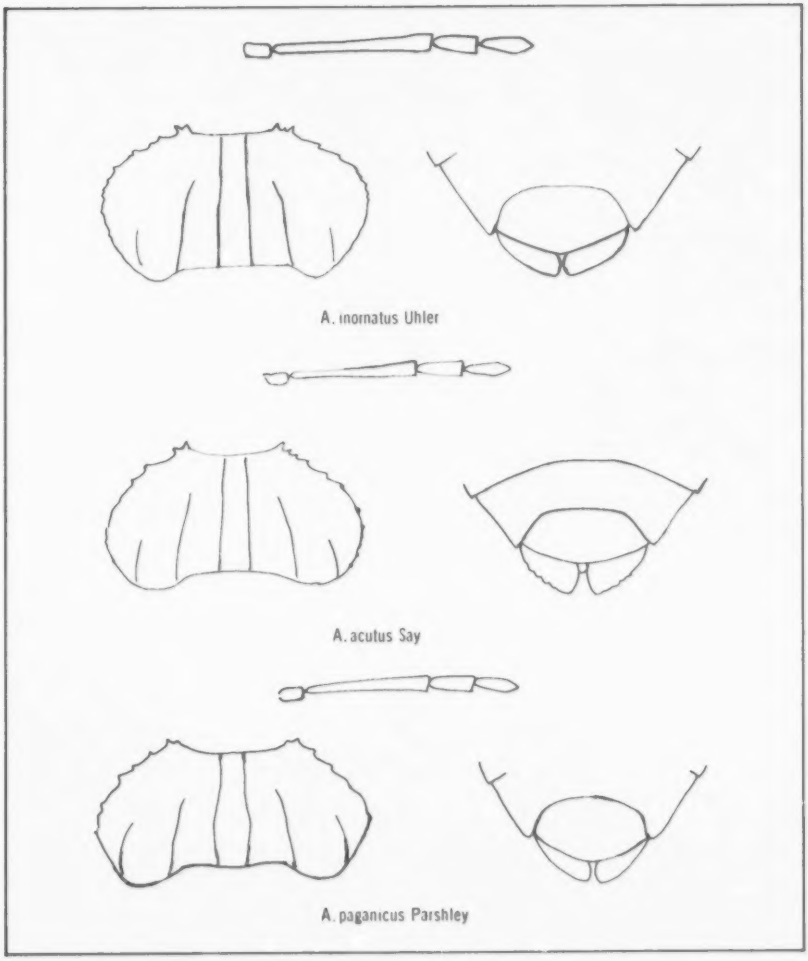


Fig. 9. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

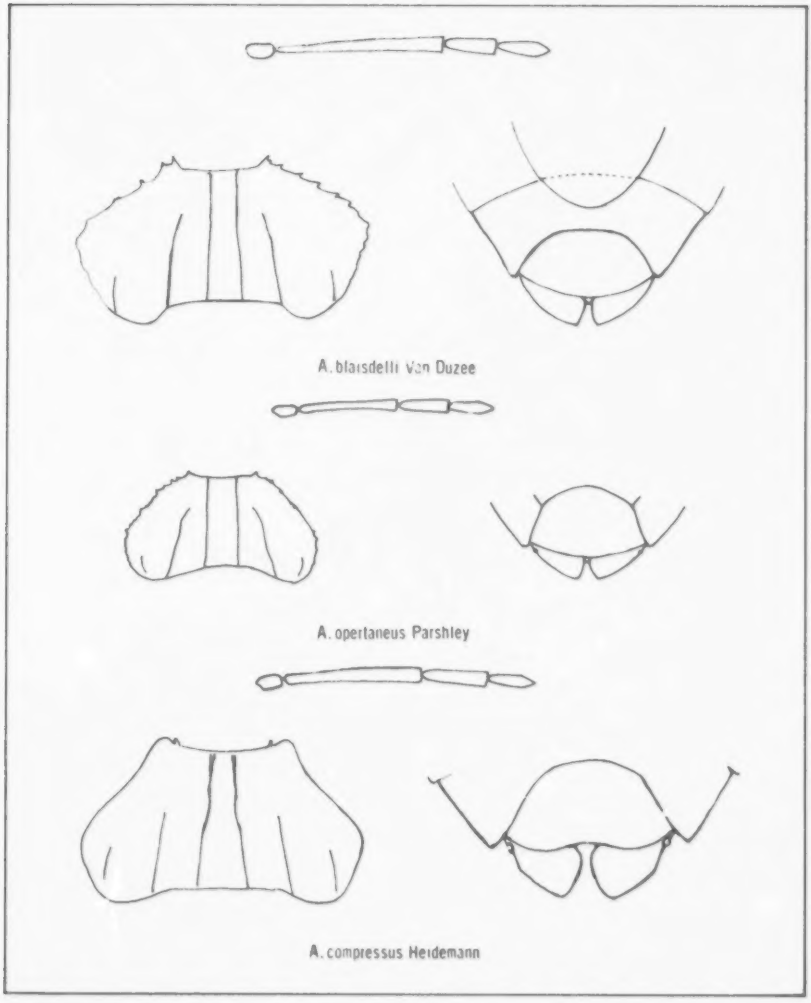


Fig. 10. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

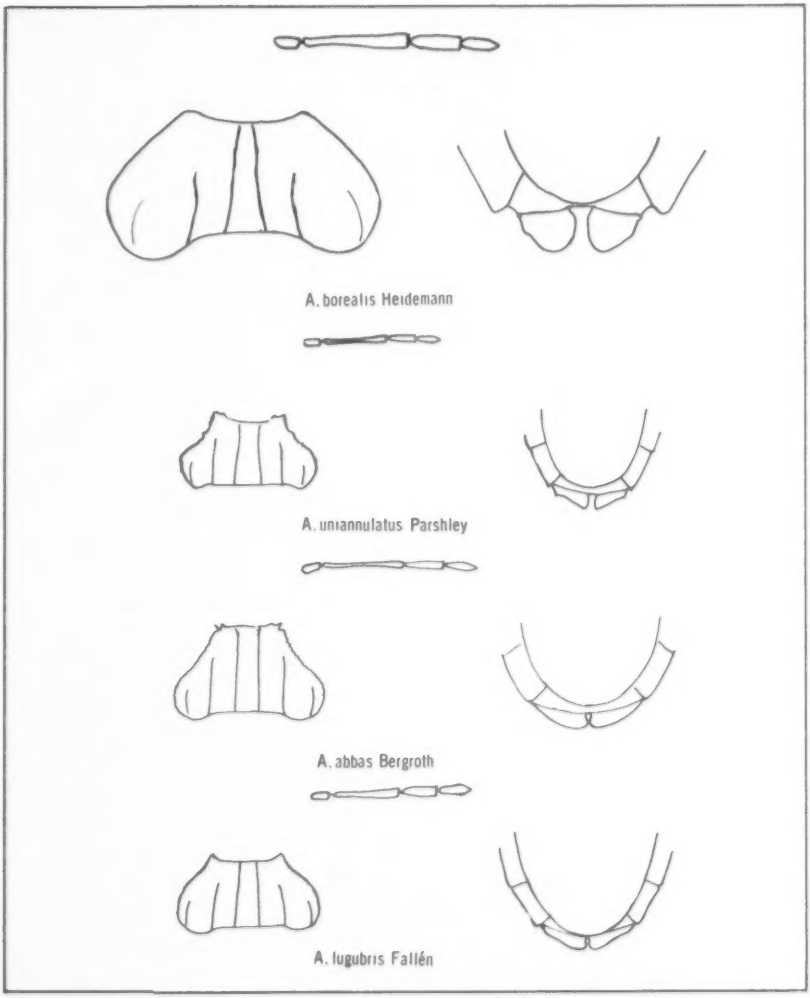


Fig. 11. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

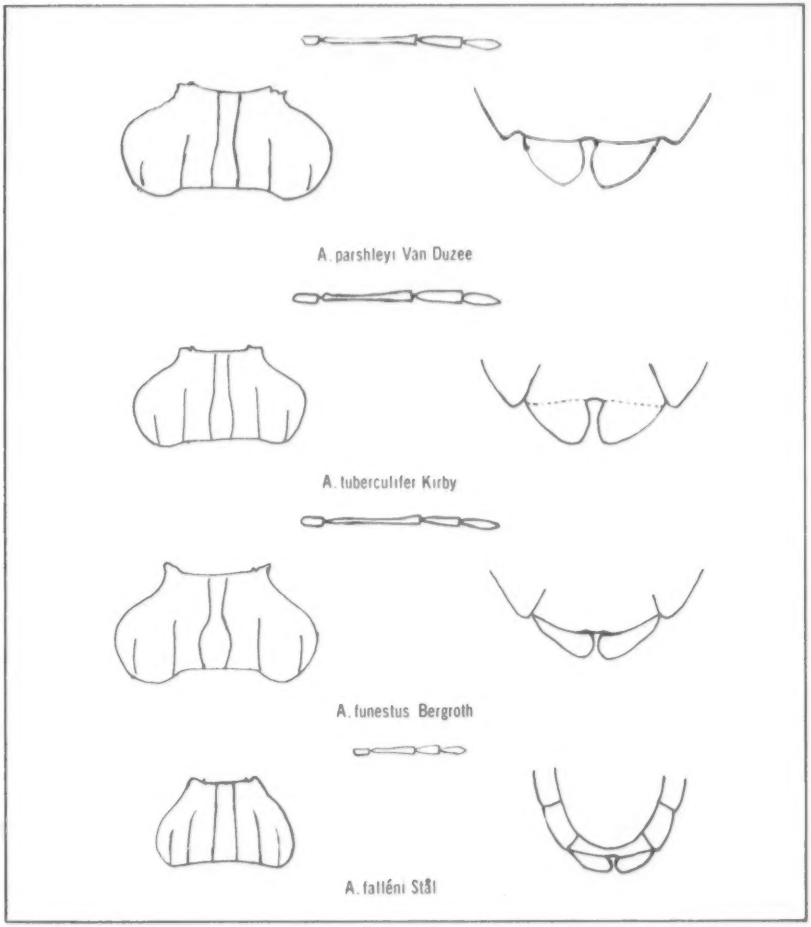


Fig. 12. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

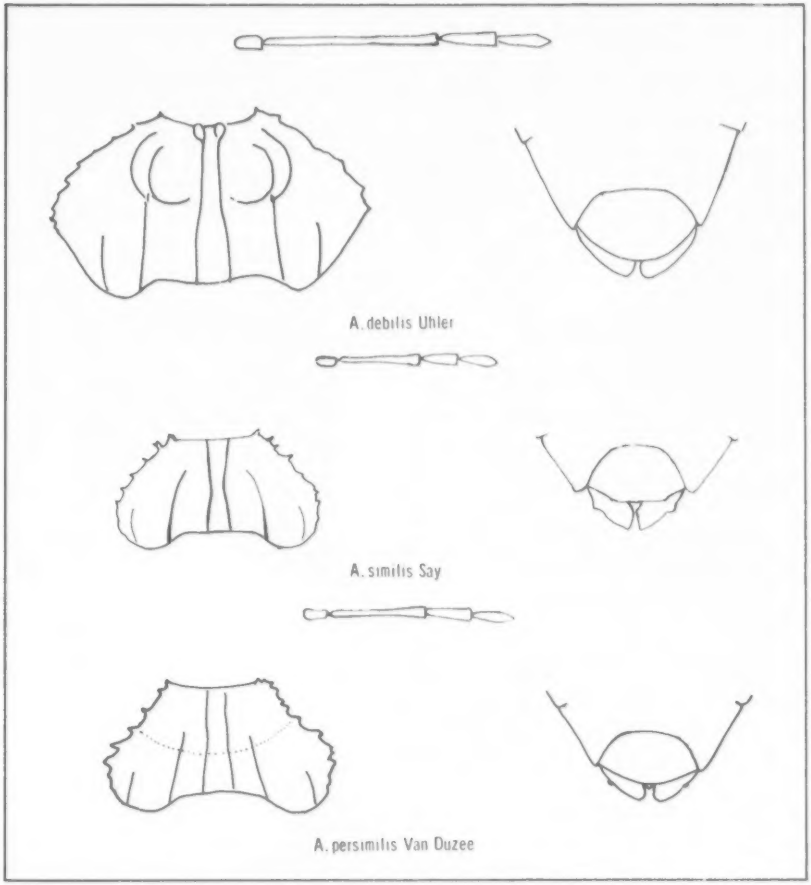


Fig. 13. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

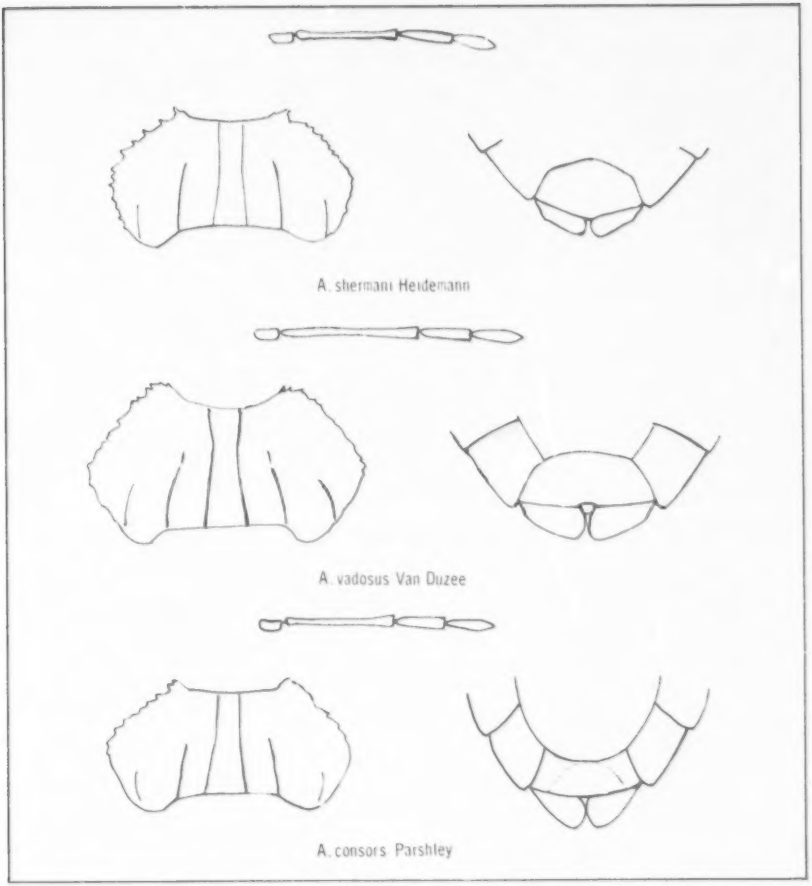


Fig. 14. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

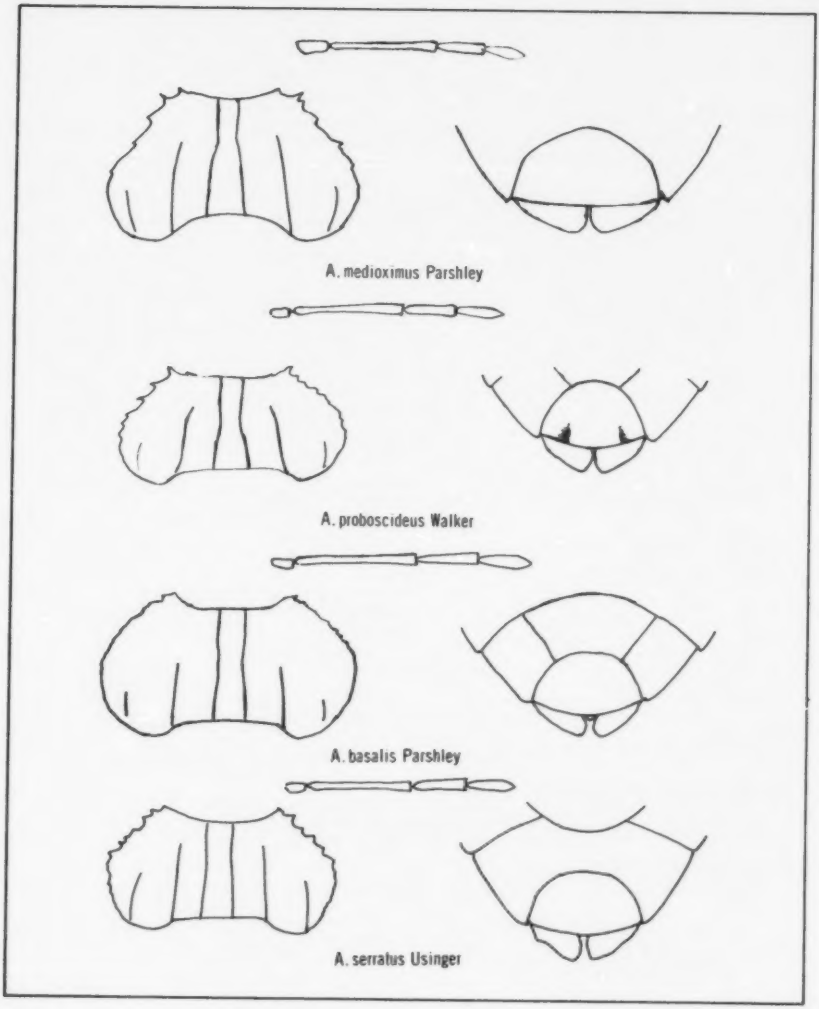


Fig. 15. Structural details of (top) antenna, (lower left) pronotum, and (lower right) dorsal view of the female 8th abdominal tergite and connexival lobes.

Plates 1–15

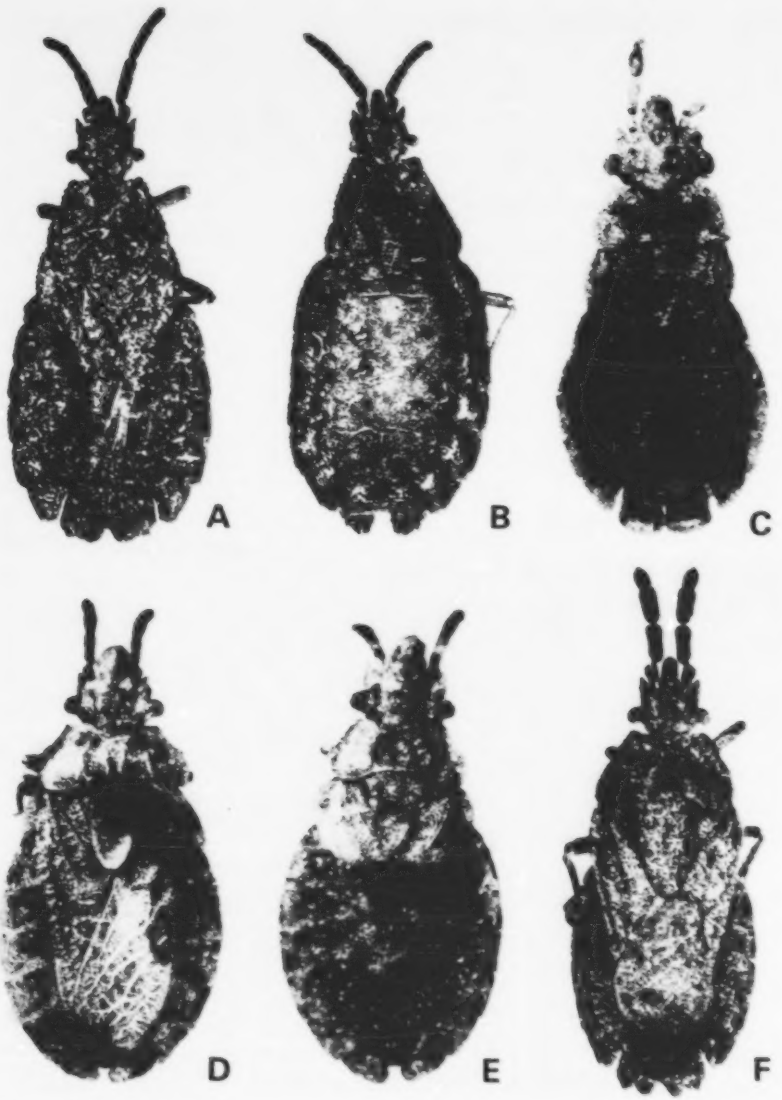


Plate 1. *A* and *B*, *Aradus heidemanni* Bergroth (*A* male, *B* female); *C–E*, *Aradus cinnamomeus* Panzer (*C* male, *D* and *E* female); *F*, *Aradus niger* Stål (male).

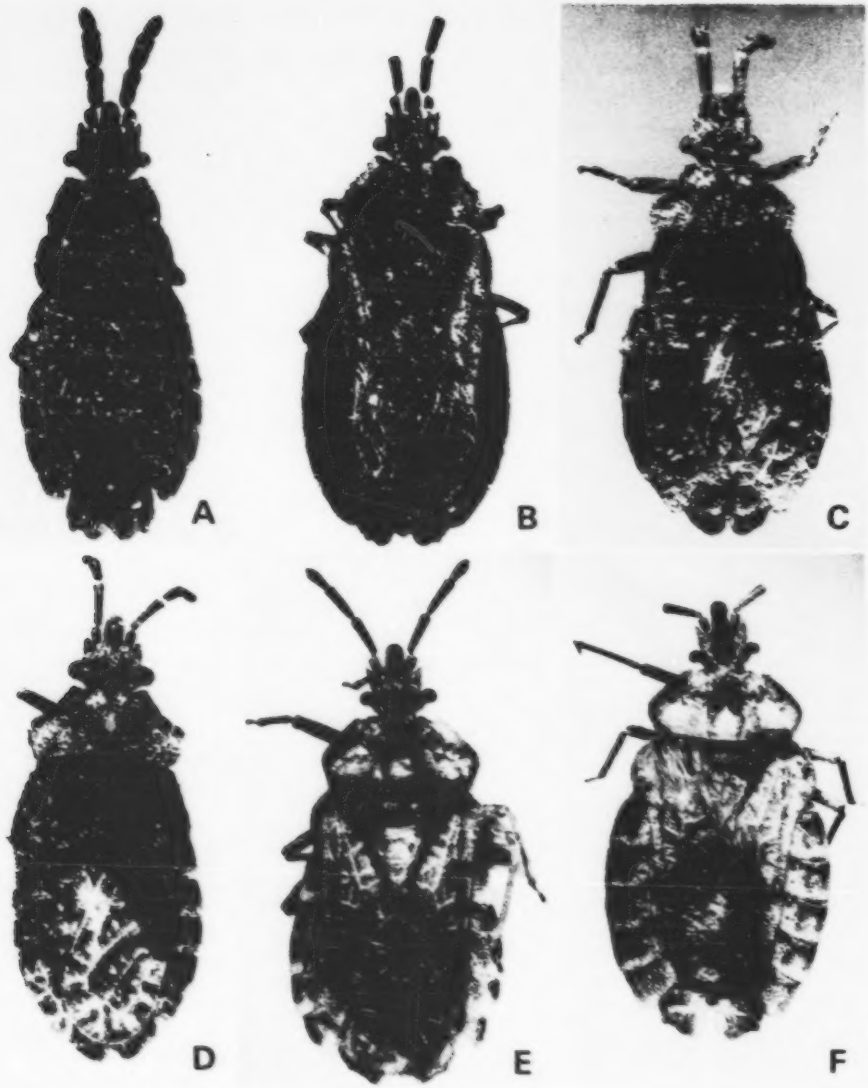


Plate 2. *A*, *Aradus niger* Stål (female); *B*, *Aradus nigrinus canadensis* Parshley (female); *C* and *D*, *Aradus insolitus* Van Duzee (*C* female, *D* male); *E* and *F*, *Aradus aequalis* Say (*E* male, *F* female).

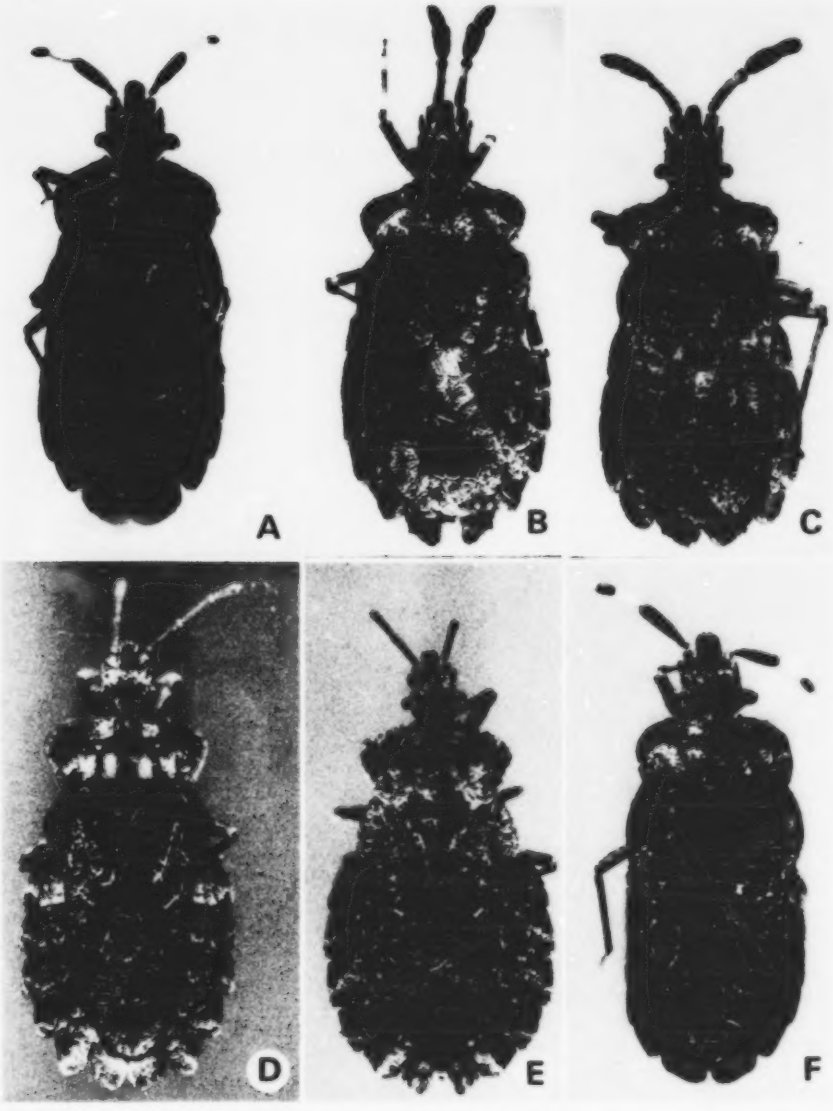


Plate 3. *A*, ***Aradus uniformis*** **Heidemann (male);** *B* **and** *C*, ***Aradus quadrilineatus*** **Say (*B* female, *C* male);** *D* **and** *E*, ***Aradus crenatus*** **Say (*D* male, *E* female);** *F*, ***Aradus martini*** **Matsuda (female).**

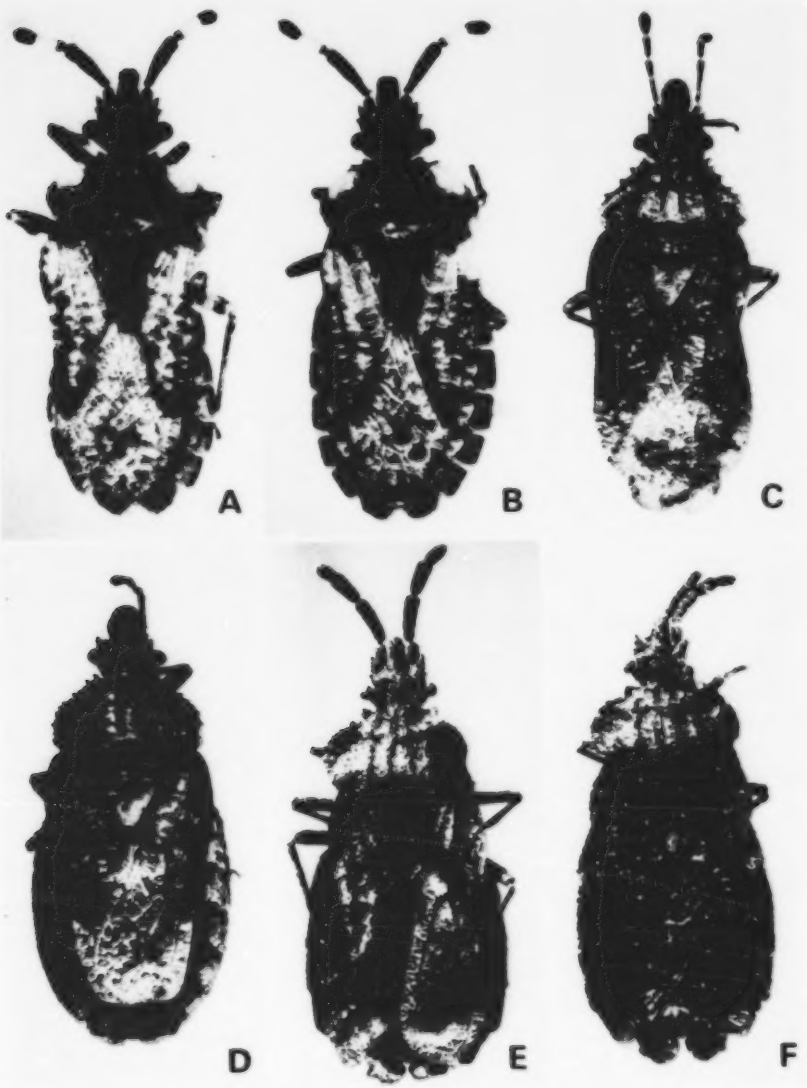


Plate 4. *A* and *B*, *Aradus depictus* Van Duzee (*A* male, *B* female); *C* and *D*, *Aradus parvicornis* Parshley (*C* male, *D* female); *E* and *F*, *Aradus montanus* Bergroth (*E* male, *F* female).

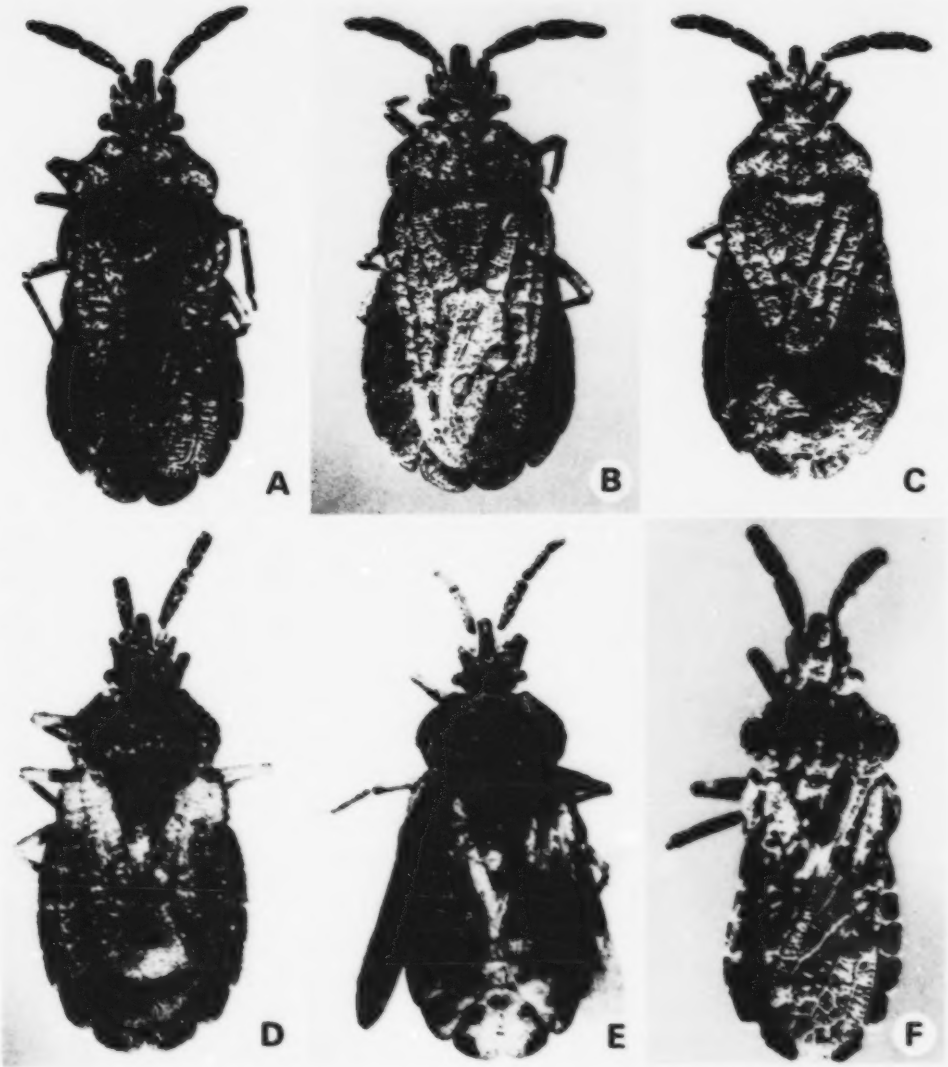


Plate 5. *A–C*, *Aradus intectus* Parshley (*A* and *B* male, *C* female); *D* and *E*, *Aradus duzeei* Bergroth; *F*, *Aradus implanus* Parshley (male).

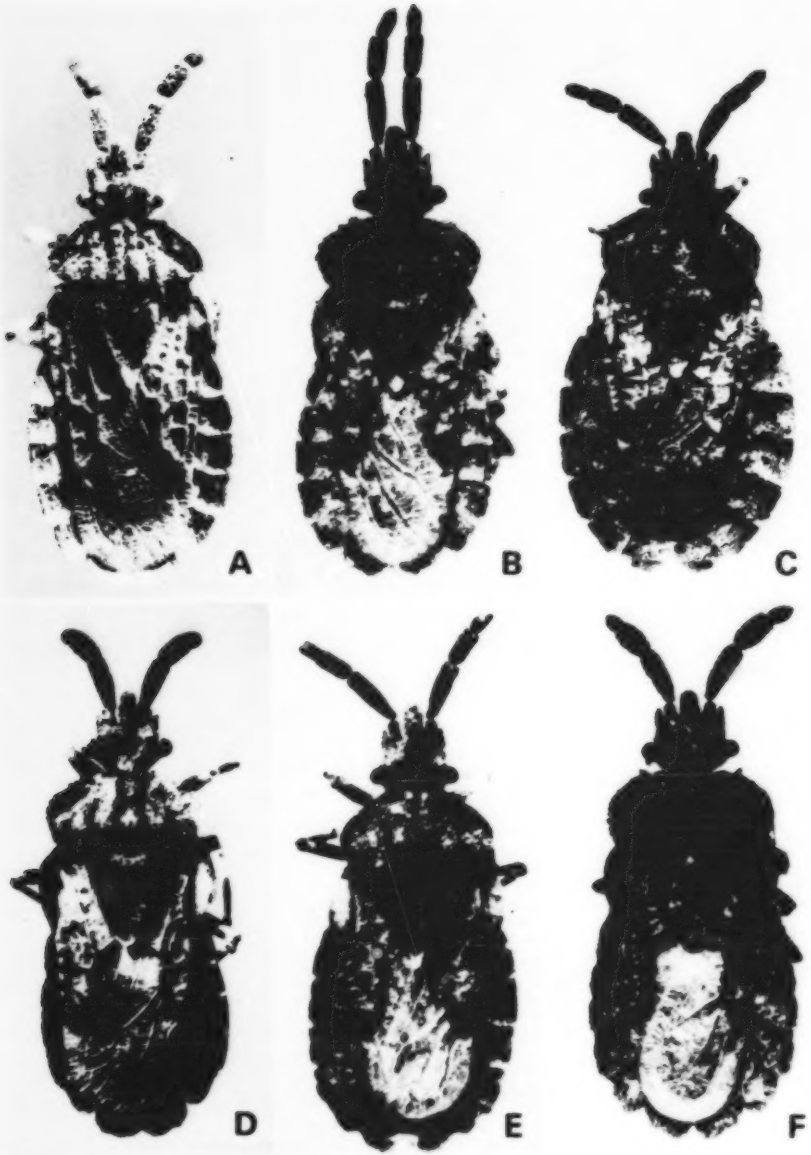


Plate 6. *A*, ***Aradus implanus*** Parshley (female); *B* and *C*, ***Aradus behrensi*** Bergroth (*B* male, *C* female); *D* and *E*, ***Aradus fuscomaculatus*** Stål (*D* male, *E* female); *F*, ***Aradus robustus*** Uhler (male).

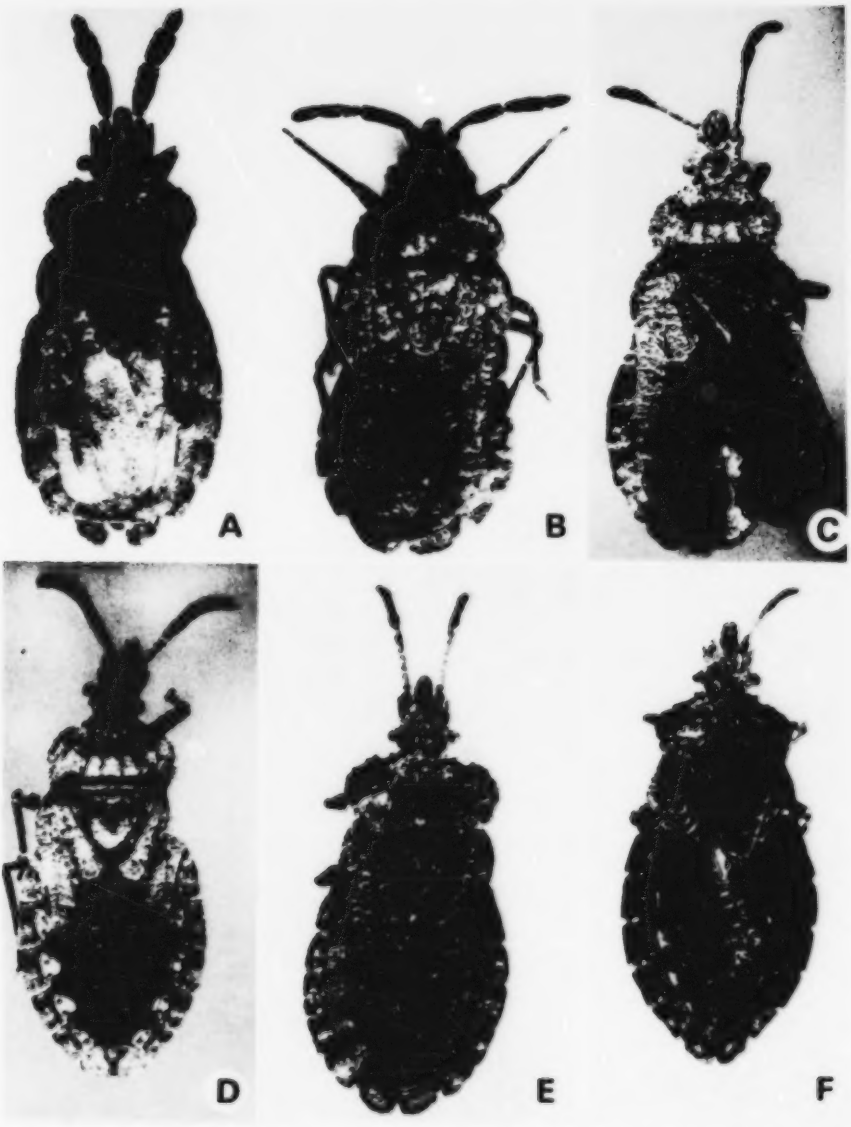


Plate 7. *A*, *Aradus robustus* Uhler (female); *B*, *Aradus saileri* Kormilev (male); *C* and *D*, *Aradus approximatus* Parshley (*C* male, *D* female); *E* and *F*, *Aradus inornatus* Uhler (*E* male, *F* female).

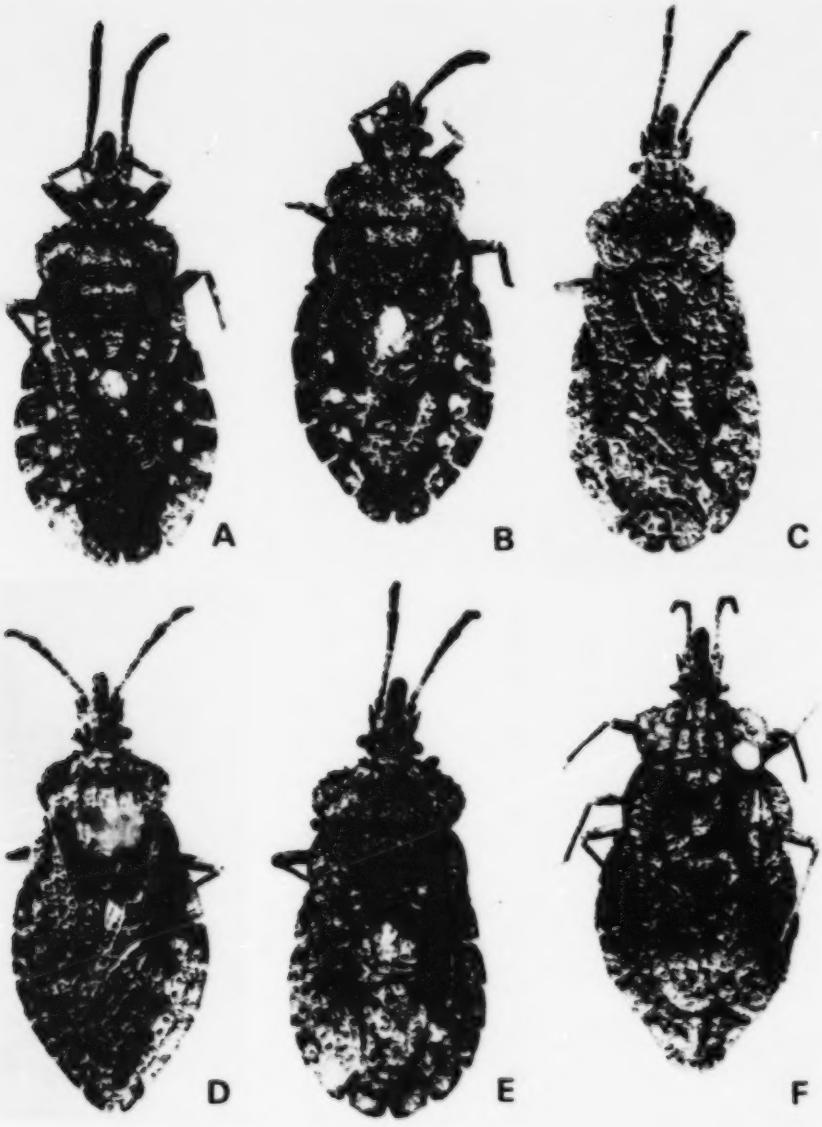


Plate 8. *A* and *B*, *Aradus acutus* Say (*A* male, *B* female); *C* and *D*, *Aradus paganicus* Parshley (*C* male, *D* female); *E* and *F*, *Aradus blaisdelli* Van Duzee (*E* male, *F* female).

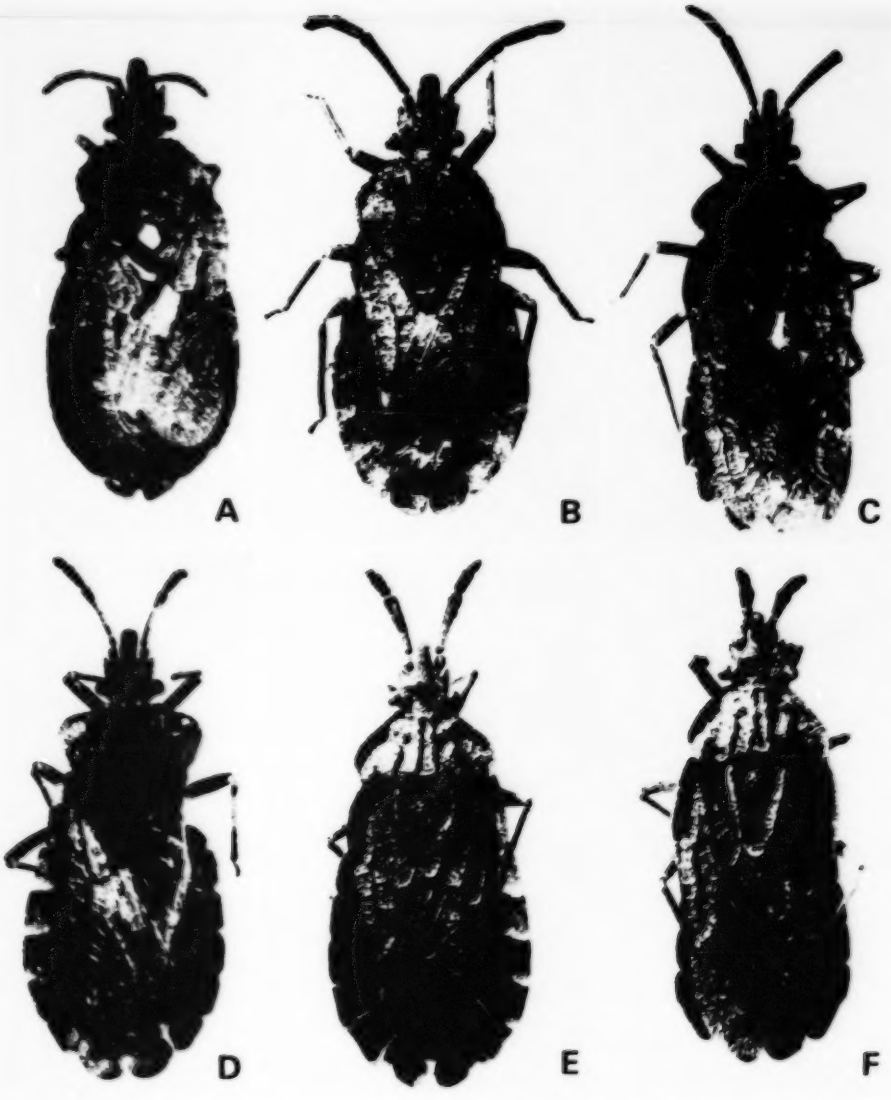


Plate 9. *A*, *Aradus opertaneus* Parshley (female); *B*, *Aradus lawrencei* Kormilev (male); *C*, *Aradus compressus* Heidemann (male); *D*, *Aradus gracilis* Parshley (female); *E* and *F*, *Aradus borealis* Heidemann (*E* female, *F* male).

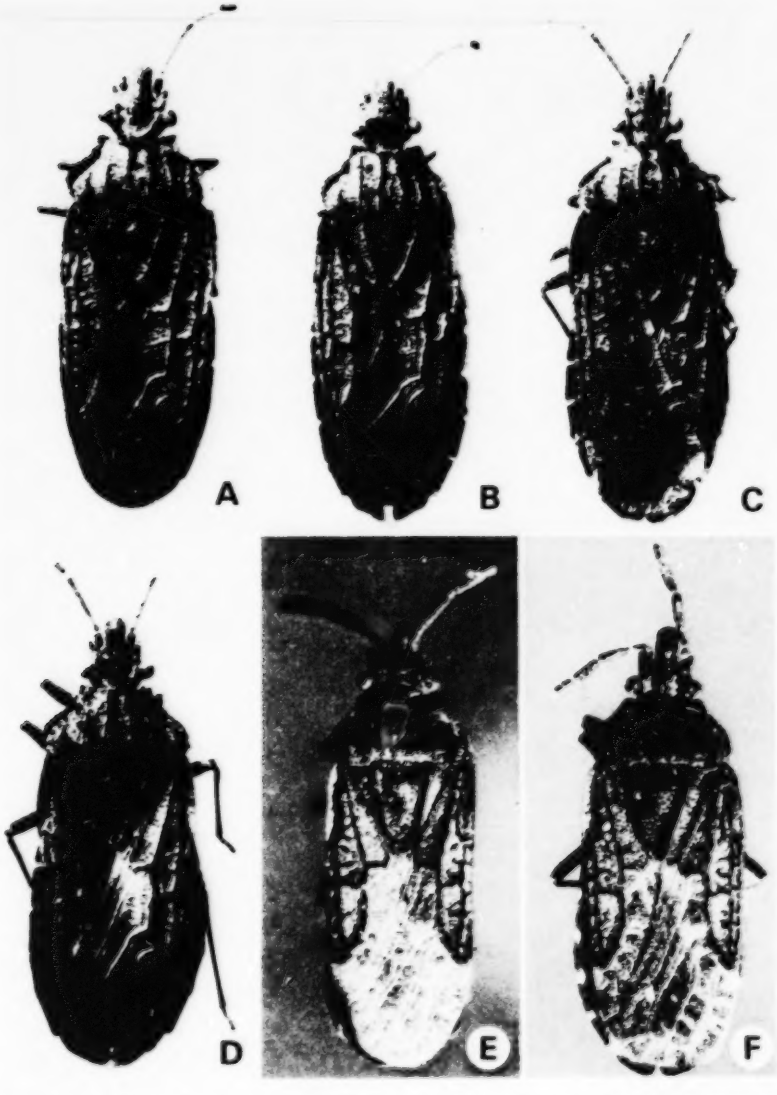


Plate 10. *A* and *B*, *Aradus uniannulatus* Parshley (*A* male, *B* female); *C* and *D*, *Aradus abbas* Bergroth (*C* male, *D* female); *E* and *F*, *Aradus lugubris* Fallén (*E* male, *F* female).

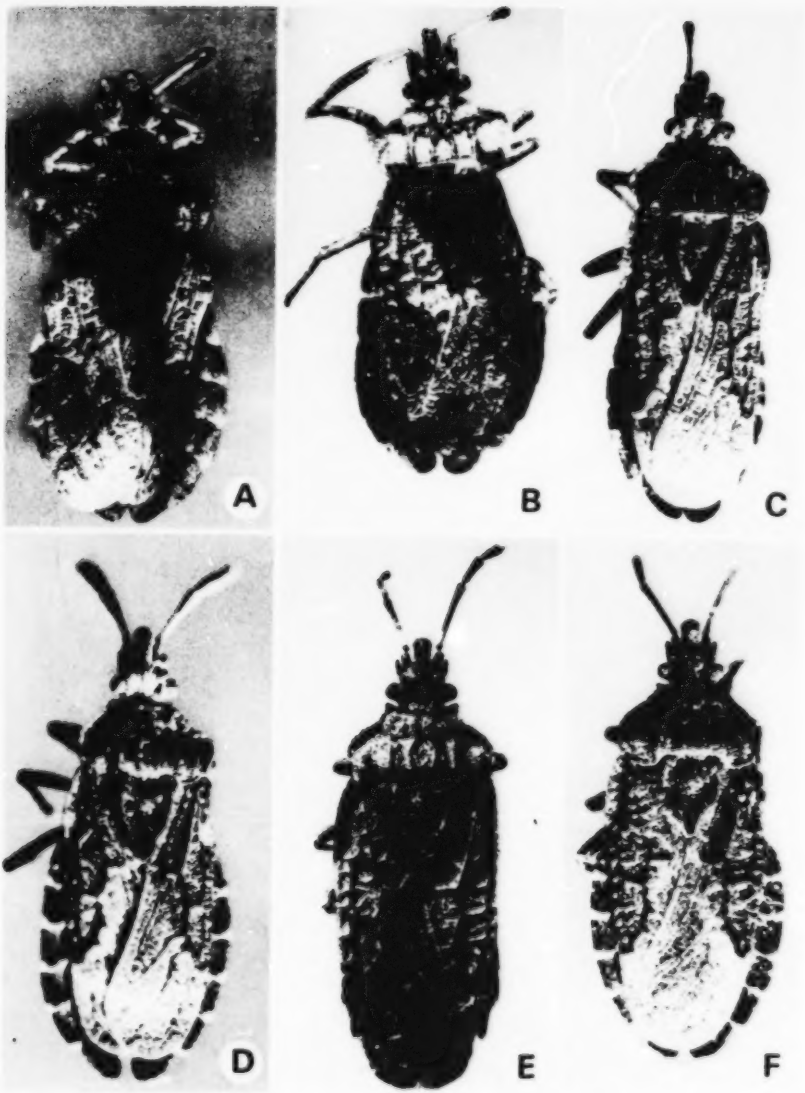


Plate 11. *A* and *B*, *Aradus parshleyi* Van Duzee (*A* male, *B* female); *C* and *D*, *Aradus tuberculifer* Kirby (*C* male, *D* female); *E* and *F*, *Aradus funestus* Bergroth (*E* male, *F* female).

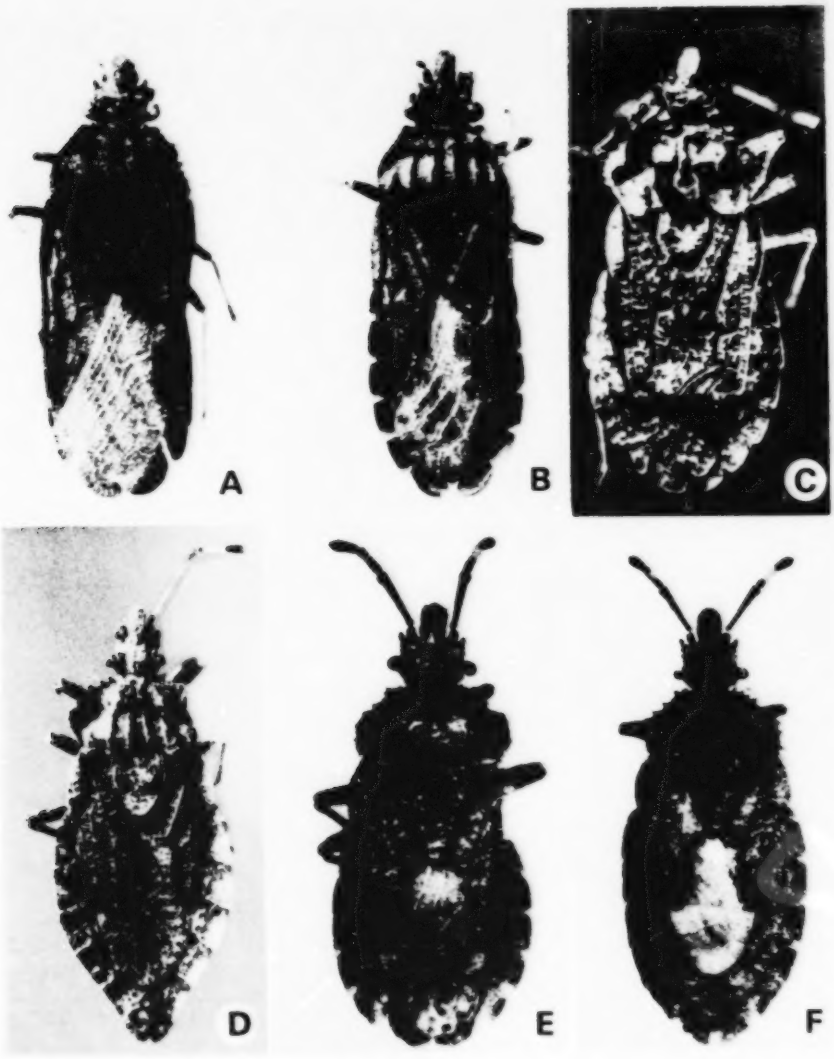


Plate 12. *A* and *B*, *Aradus falléni* Stål (*A* male, *B* female); *C* and *D*, *Aradus debilis* Uhler (*C* male, *D* female); *E* and *F*, *Aradus similis* Say (*E* male, *F* female).

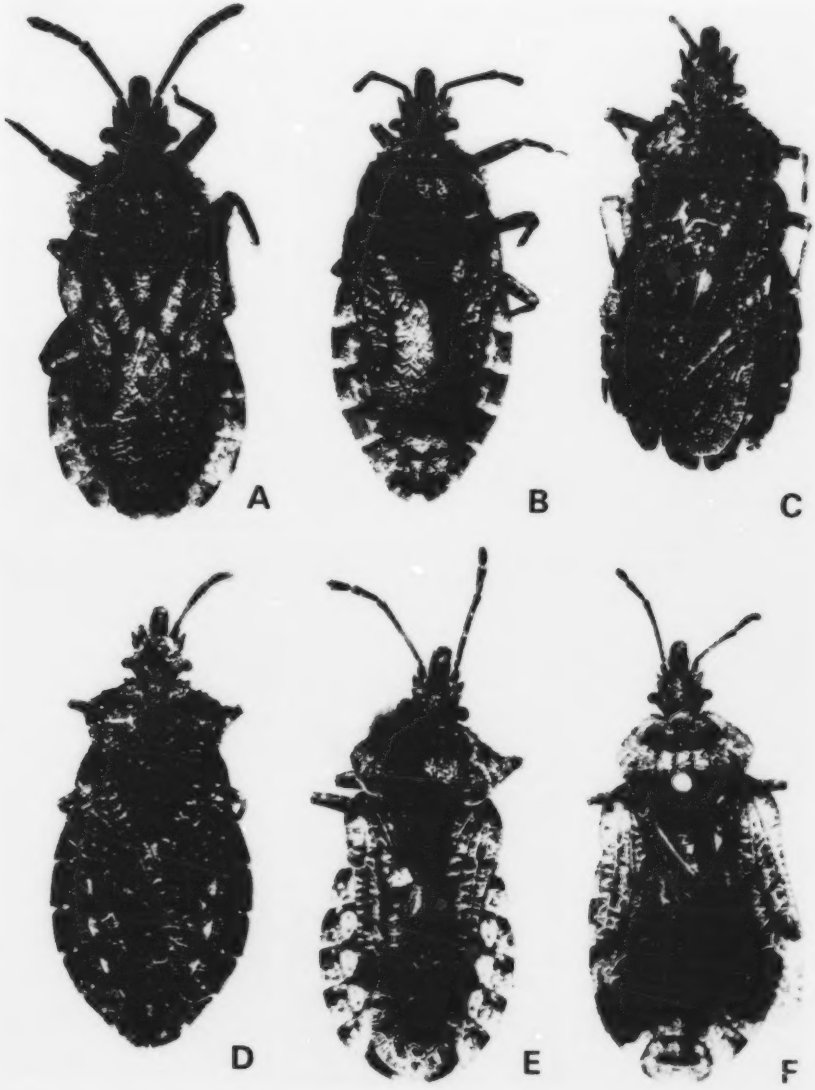


Plate 13. *A* and *B*, *Aradus persimilis* Van Duzee (*A* male, *B* female); *C* and *D*, *Aradus shermani* Heidemann (*C* male, *D* female); *E* and *F*, *Aradus vadosus* Van Duzee (*E* male, *F* female).

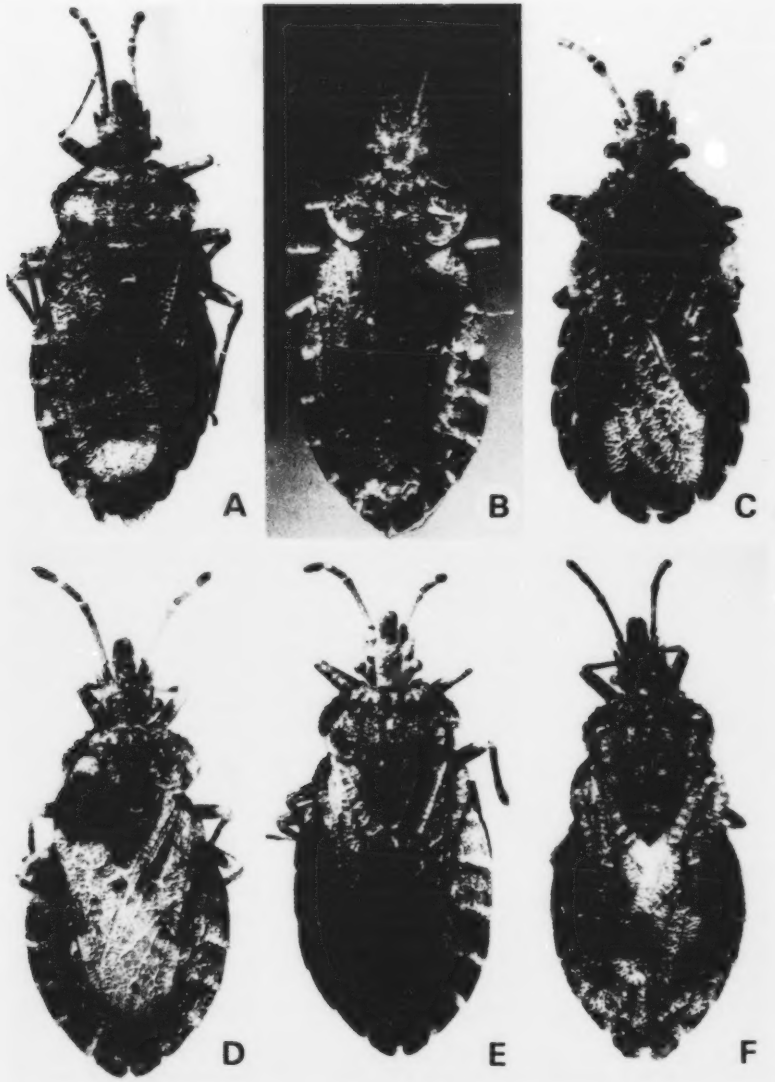


Plate 14. *A*, *Aradus consors* Parshley (female); *B*, *Aradus medioximus* Parshley (female); *C* and *D*, *Aradus proboscideus* Walker; *E*, *Aradus basalis* Parshley (female); *F*, *Aradus serratus* Usinger (female).

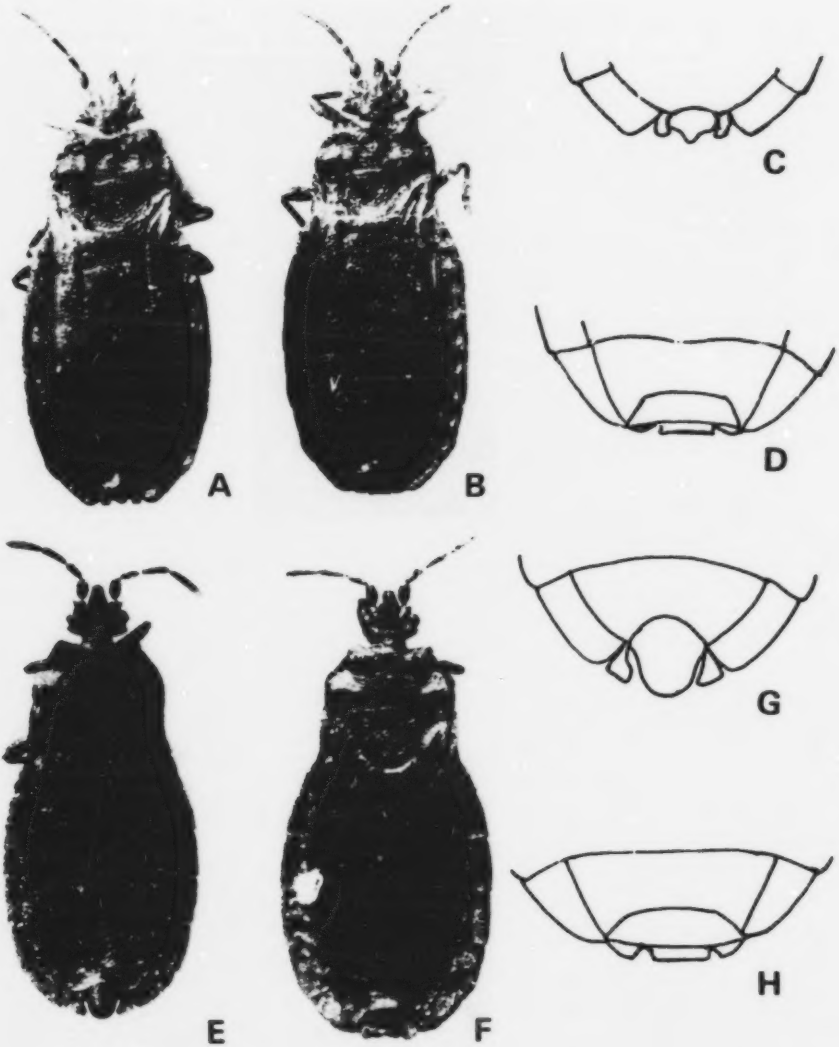


Plate 15. *A* and *B*, *Aneurus septentrionalis* Walker (*A* male, *B* female); *C* and *D*, dorsal view of posterior abdominal segments in male (*C*) and female (*D*) of *Aneurus septentrionalis* Walker; *E* and *F*, *Aneurus inconstans* Uhler (*E* male, *F* female); *G* and *H*, dorsal view of posterior abdominal segments in male (*E*) and female (*F*) of *Aneurus inconstans*.

Glossary

abdomen: the third or posterior division of the body without legs.
anal vein: the sixth vein of the generalized wing (see Pl. 1*E*).
antemedian: situated before the middle.
antenna (pl. antennae): paired, segmented sensory organs, borne on either side of the head. The segment directly attached to the head is the first antennal segment.
antenniferous tubercle: a small process (tubercle) bearing the antenna.
anterior: situated in front; before in location, opposed to posterior.
apex (pl. apices): that part of any area (or segment) opposite the base by which it is attached.
aptery (adj. apterous): the condition of lacking wings.

brachyptery (adj. brachypterous): the condition of having short wings.

callosity: a thick swollen hump.
callus (pl. calli): a hard hump or swelling of the cuticle.
carina (pl. carinae): an elevated ridge or keel.
carinate: keeled, having keels or carinae.
clypeus: the morphological term referring to the median process in Aradidae (*see* Fig. 1*D*).
connexival lobe: the lobate connexival part of the definitive 8th abdominal segment in the female of *Aradus* (*see* Fig. 2).
connexival segment: the connexival part of each abdominal segment.
connexivum (pl. connexiva): the marginal area of the abdomen in Heteroptera; in Aradidae the connexivum is dorsally demarcated by a longitudinal line.
convergent: approaching each other toward the tip.
corium: the basal leathery part of the hemelytron (fore wing) in Heteroptera.
crenate: having the margin cut into scallops.
crenulate: with small scallops, evenly rounded and rather deeply curved.
cubital vein: the fifth vein of the generalized wing (*see* Pl. 1*E*).

denticulate: set with small teeth or notches.
discoidal: having a shape like a round plate.
divergent: spreading out from a common base.
dorsal: upper.

explanate: spread out and flattened; applied to a margin.

family: a taxonomic category ranking above genus, comprising related genera.
femur (pl. femora): the thigh; the stoutest segment of the leg joined to the body through two inconspicuous segments (trochanter and coxa).
fungivorous: feeding on fungi; mycetophagous.
fuscous: dark brown.

genitalia: the collective term for all genital structures.
genus (pl. genera): a taxonomic category ranking between species and family, comprising related species.

hemelytron (pl. hemelytra): the anterior wing of Heteroptera, in which the basal half is thickened and the apical half membranous.

hyaline: transparent or partly so.

labium (pl. labia): the lower lip, forming the rostrum, or beak, in Heteroptera including Aradidae.
lateral carinae: a pair of short ridges along the side (lateral) margins of the pronotum.
lobate: having lobes.

macroptery (adj. macropterous): the condition of having fully developed wings.
maculation: the ornamentation or pattern of markings.
mandible: the jaw. In Aradidae it is represented by the mandibular stylet coiled up within the head.
mandibular stylet: *see* mandible.
maxilla: the second jaw. In Aradidae it is represented by the maxillary stylet coiled up within the head.
maxillary stylet: *see* maxilla.
medial vein: the fourth vein in the generalized wing (*see* Pl. 1*E*).
median carinae (sing. carina): the median pair of longitudinal ridges on the pronotum.
median process: the anterior median projection of the head: morphologically the clypeus (*see* Fig. 1*B, D*).
metasternum: the ventral (lower) part of the third (from front) thoracic (chest) segment, or metathorax.
micropterv (adj. micropterous): the condition of having minute wings.
mycetophagous: feeding on fungi; fungivorous.

obliterated: nearly rubbed out; indistinct.
obovate: inversely egg-shaped.
obtuse: not pointed; at an angle greater than a right angle.
opisthognathous: having a posterior ventral position of the mouthparts, resulting from a deflection of the facial portion of the head.
ovate: egg-shaped in outline; oval.
ovipositor: the egg-laying apparatus.

paramedian carinae: a pair of longitudinal ridges on each side of the median carinae on the pronotum.
petiolated: having a stalk or petiole.
polymorphic: occurring in several forms.
posterior: situated at or toward the hinder or hindmost end; opposed to anterior.
postocular: situated back of or behind the eye.
postocular spine: a spine-like projection behind the eye in *Aneurus*.
postocular tubercle: a tubercle behind the eye in *Aradus* (*see* Fig. 1*D*).
preapical: situated in front of the apex.
preocular tubercle: a small process situated in front of the eye (*see* Fig. 1*D*).
process: a prolongation of the surface, a margin, or an appendage; any prominent part of the body not otherwise definable.
pronotum: the dorsal (upper) part of the first thoracic segment or the prothorax.
prosternum: the ventral (lower) piece of the frontmost thoracic (chest) segment or the prothorax.

pygophore: the genital capsule formed by fusion of tergal (dorsal) and pleural (lateral) parts of the 9th abdominal segment. In *Aradus* the sternum of the 9th segment is also involved.

radial vein: the third vein in the generalized wing (*see* Pl. 1*E*).
rectangular: in the form of a parallelogram all of whose angles are right angles.
reflected: bent up or back.
rostrum: the beak.
rugose: wrinkled.
rugulose: minutely wrinkled.

scutellum: a triangular (in *Aradus*) or half-moon-shaped (in *Aneurus*) plate exposed between hemelytra (fore wings).
semirectangular: almost in the form of a right angle.
serrate: saw-like, having notched edges like the teeth of a saw.
serrulate: finely serrated.
sinuate: wavy; referring specifically to edges or margins.
spinous: having spines.
spiracle: the external opening of the respiratory system; a breathing pore.
stenoptery (adj. stenopterous): the condition of having narrowed wings.
sternite: the ventral piece of a segment, usually referring to those of abdominal segments.
stylet: a small style or stiff process.
subcostal vein: the second vein of the generalized wing (*see* Pl. 1*E*).
subfamily: a subcategory within the category family; two or more subfamilies compose a family.
subparallel: almost parallel.

taxonomy: the arranging of species and groups into a system that shows their relationships to each other and their places in a natural classification.
tergite: the dorsal (upper) part of an abdominal segment.
thorax (adj. thoracic): the second or intermediate region of the insect body bearing three pairs of legs and wings, made up of three rings, named in order, pro-, meso-, and meta-thorax.
tibia (pl. tibiae): the slender fourth division of the leg, joined at the proximal end to the femur.
translucent: semitransparent, admitting the passage of light but not of vision.
trapezoidal: in the form of a four-sided figure of which two sides are parallel and two are not.
tubercle: a small rough prominence.
tylus: the median process of the head in Aradidae, and morphologically the clypeus.

unicolorous: of one color throughout.

valvifer: basal plates bearing the ovipositor in the 8th and 9th abdominal segments.
valvula (pl. valvulae): a small valve.
ventral: lower.
vertex: the dorsal (upper) area of the head between the eyes.

References

Amyot, C. J. B., and Serville, J. G. A. 1843. Histoire naturelle des insectes, Hémiptères. Paris. pp. 303-309.

Bergroth, E. 1886. Ueber einige amerikanische Aradiden. Wien. Entomol. Ztg. 5(3):97-98.

Bergroth, E. 1887. Notes sur quelques Aradides nouveaux ou peu connus. Rev. Entomol. Caen 6:244-247.

Bergroth, E. 1889. Sur quelques Aradides appartenant au Musée Royal d'Histoire Naturelle de Bruxelles. Bull. Ann. Soc. R. Entomol. Belg. 33:clxxx-clxxxii.

Bergroth, E. 1892. Notes on the Nearctic Aradidae. Proc. Entomol. Soc. Wash. 2(3):332-337.

Bergroth, E. 1906. Notes on American Hemiptera. I. Can. Entomol. 38:198-202.

Bergroth, E. 1913. Notes on American Hemiptera. II. Aradidae. Can. Entomol. 45(1):1-8.

Curtis, J. 1825. British entomology, London. 7:Pl. 230, p. 86.

Douglas, J. W., and Scott, J. 1865. The British Hemiptera, London. I: 26, 267-275.

Fabricius, J. C. 1803. Systema Rhyngotorum. Brunsvigae. pp. 2, 31-35, 116-120.

Fallén, C. F. 1807. Monographia Cimicum Sueciae. Hafniae. pp. 18-19.

Franz, J. M. 1961. Biological control of pest insects in Europe. Ann. Rev. Entomol. 6:183-200.

Fyles, T. W. 1903. *Aratus* (sic) *luteolus*, n. sp. Can. Entomol. 35:75-76.

Heidemann, O. 1901. Notes on *Aradus (Quilnus) niger* Stål. Proc. Entomol. Soc. Wash. 4:389-390

Heidemann, O. 1904. Notes on a few Aradidae occurring north of the Mexican boundary. Proc. Entomol. Soc. Wash. 6:229-233.

Heidemann, O. 1907. Three new species of North American Aradidae. Proc. Entomol. Soc. Wash. 8:68-71.

Heidemann, O. 1909. Two new species of North American Aradidae. Proc. Entomol. Soc. Wash. 11:189-191.

Kirby, W. 1837. The insects in Richardson's *Fauna Boreali Americana*, Norwich. 4:278-279.

Kirby, W. F. 1878. Insects of the northern parts of British America. Can. Entomol. 10:213-218.

Kiritschenko, A. N. 1913. Dysodiidae and Aradidae [In Russian with Latin descriptions]. Faune de la Russie, Insectes Hémiptères 6(1):ii, 301 pp., 2 pls.

Kormilev, N. 1966*a*. Two new American Aradidae (Hemiptera-Heteroptera). Psyche (Camb. Mass.) 73:26-29.

Kormilev, N. A. 1966*b*. Notes on Aradidae in the U.S. National Museum, IV (Hemiptera: Heteroptera). Proc. U.S. Natl. Mus. 119(3548):1-25.

Kormilev, N. A. 1968. North and Central American species of *Aneurus* Curtis (Hemiptera: Aradidae). Proc. U.S. Natl. Mus. 125(3657):1-12.

Kumar, R. 1967. Morphology of the reproductive and alimentary systems of the Aradoidea (Hemiptera), with comments on relationships within the superfamily. Ann. Entomol. Soc. Am. 60:17-25.

Matsuda, R. 1971. A new species of *Aradus* (Aradidae: Hemiptera). Can. Entomol. 103:1195-1196.

Moser, J. C., Thatcher, R. C., and Pickard, L. S. 1971. Relative abundance of southern pine beetle associates in East Texas. Ann. Entomol. Soc. Am. 64:72-77.

Osborn, H. 1903. Aradidae of Ohio. Ohio Nat. 4:36-42.

Overgaard, N. A. 1968. Insects associated with the southern pine beetle in Texas, Louisiana, and Mississippi. J. Econ. Entomol. 61:1197-1203.

Panzer, G. W. F. 1794. Fauna Insectorum Germanicae Initia. Nürnberg. 100:1-24.

Parshley, H. M. 1921. Essay on the American species of *Aradus* (Hemiptera). Trans. Am. Entomol. Soc. 47:1-106, 7 pls.

Parshley, H. M. 1929. New species and new records of *Aradus*. Can. Entomol. 61:243-246.

Powell, J. M. 1971. The arthropod fauna collected from the comandra blister rust, *Cronartium comandrae*, on lodgepole pine in Alberta. Can. Entomol. 103:908-918.

Say, T. 1825. Descriptions of new hemipterous insects collected in the expedition to the Rocky Mountains, performed by order of Mr. Calhoun, Secretary of War, under command of Major Long. J. Acad. Nat. Sci. Phila. 4:307-345.

Say, T. 1832. Descriptions of new species of heteropterous Hemiptera of North America. 1:39. *In* Complete writings 1:350-355.

Stål, C. 1859. Kongliga Svenska Fregattens Eugenies resa omkring jorden. Sven. Vetenskapsakad. p. 260.

Stål, C. 1860. Bidrag till Rio de Janeiro-traktens Hemiptera-fauna. K. Sven. Vetenskapsakad. Handl. 2(7):66-68.

Strawinski, A. 1925. Historja naturalna Korowca Sosnowege *Aradus cinnamomeus* Pnz. (Hemiptera-Heteroptera). Rocz. Nauk. Roln. i Lesn. 13:644-693, 4 pls.

Strickland, E. H. 1953. An annotated list of the Hemiptera (s.l.) of Alberta. Can. Entomol. 85:193-226.

Tanada, Y. 1959. Microbial control of insect pests. Ann. Rev. Entomol. 4:277-295.

Uhler, P. R. 1871. Notes on some Heteroptera in the collection of Dr. T. W. Harris. Proc. Boston Soc. Nat. Hist. 14:104-106.

Uhler, P. R. 1876. List of the Hemiptera of the region west of the Mississippi River including those collected during the Heyden explorations of 1873. Bull. U.S. Geol. Geogr. Surv. Terr. 1:323 pp.

Uhler, P. R. 1886. Check list of the Hemiptera Heteroptera of North America. Brooklyn. 148 pp.

Uhler, P. R. 1893. Summary of the collection of Hemiptera secured by Mr. E. A. Schwarz in Utah. Proc. Entomol. Soc. Wash. II:366-385.

Usinger, R. L. 1936. Studies on the American Aradidae with descriptions of new species. Ann. Entomol. Soc. Am. 29(3):490-516, 2 pls.

Usinger, R. L., and Matsuda, R. 1959. Classification of the Aradidae (Hemiptera-Heteroptera). Br. Mus. Monogr. 410 pp.

Van Duzee, E. P. 1912. Synonymy of the Provancher Collection of Hemiptera. Can. Entomol. 44:317-329.

Van Duzee, E. P. 1916. Notes on some Hemiptera taken near Lake Tahoe, California. Univ. Calif. Publ. Entomol. 1:231-234.

Van Duzee, E. P. 1917*a*. Report on a collection of Hemiptera made by Walter M. Gifford in 1916 and 1917, chiefly in California. Proc. Calif. Acad. Sci., Ser. 7, 4:253-254.

Van Duzee, E. P. 1917*b*. Catalogue of the Hemiptera of America north of Mexico. Univ. Calif. Publ. Entomol. 2:486 pp.

Van Duzee, E. P. 1920. New hemipterous insects of the genera *Aradus*, *Phytocoris* and *Camptobrochys*. Proc. Calif. Acad. Sci. 9(4):311-339.

Walker, F. 1873. Catalogue of the specimens of Hemiptera-Heteroptera in the Collection of the British Museum, London. Part 7. Br. Mus. Publ. pp. 6-44.